

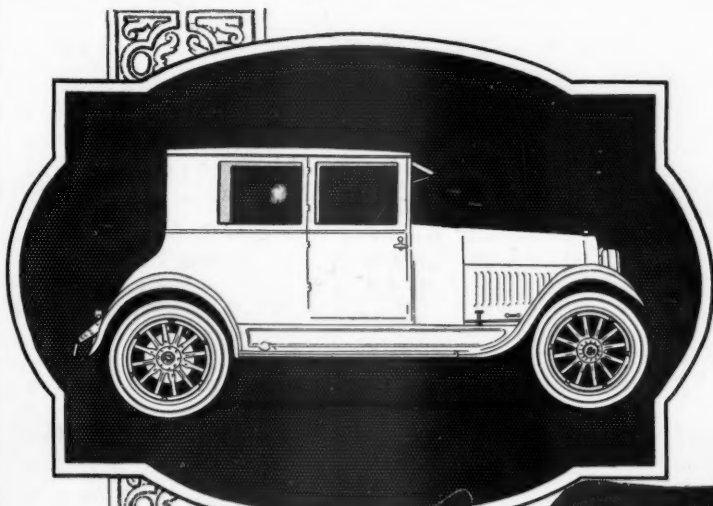
MOTOR AGE

Vol. XLI
Number 14

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CHICAGO, APRIL 6, 1922

Thirty-five Cents a Copy
Three Dollars a Year

H U D S O N



The
Coach
Five Passenger

**Has Won
Instant Popularity**

\$1795

Emphatic new attractions are now combined with the reputation of the Hudson Super-Six. The new Coach offers these attractions in full measure.

Low price. At \$1795 it costs but a few dollars more than the touring models. Yet it offers the wanted comforts and all-season utility of a fine enclosed car.

The Coach is beautiful, too. Any dealer will be proud of its handsome appearance on his floor.

And it provides him with the selling points that meet buyers' desires today.

The immediate, unmistakable welcome the Coach is receiving proves this. Hudson has always been the largest selling of the fine cars. The distinct advance in design marked by the Coach, reinforces this enviable position.

Some desirable territories are still open. Wouldn't you like to sell this new Hudson?

Phaeton - -	\$1695
7-Pass. Phaeton	1745
Coach - -	1795
Cabriolet - -	2295
Coupe - -	2570
Sedan - -	2650
Tour. Limousine	2920
Limousine - -	3495

Freight and Tax Extra

HUDSON MOTOR CAR COMPANY, DETROIT

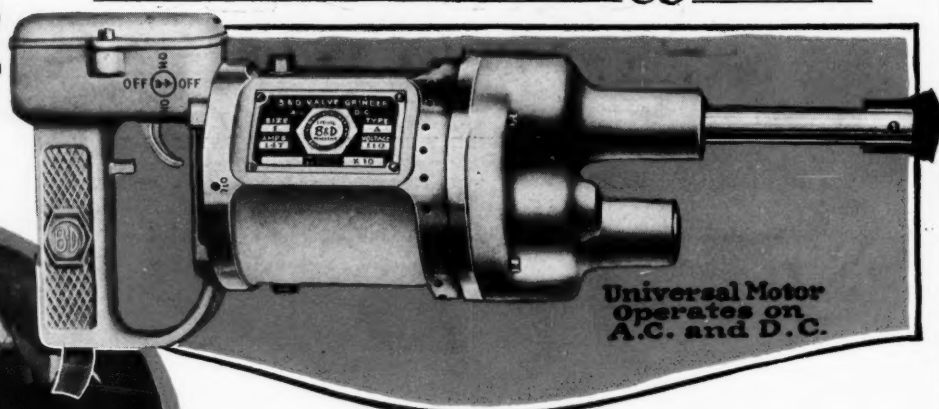
BLACK & DECKER

ELECTRIC VALVE GRINDER

\$45.00

**WEIGHT
8 POUNDS**

"With the Pistol Grip and Trigger Switch"



Universal Motor
Operates on
A.C. and D.C.

IF an eight cylinder car requires one man's labor for five hours to perform the actual grinding operation and he charges his customer \$1.25 per hour he will have to charge \$6.25 for the grinding work.

As the Black & Decker Electric Valve Grinder performs the work more than four times as fast as it can be done by hand, the same man can grind the valves on at least four eight cylinder motors in the same length of time (5 hours.)

Instead of charging your customer \$6.25 for each grinding job, which is what you would have to charge him, if the work was done by hand, at the rate of \$1.25 per hour, by using the Black & Decker Electric Valve Grinder, you can establish a flat rate of \$5.00 for the actual valve grinding operation on an eight cylinder motor, and you will receive \$20.00 for five hours work instead of \$6.25, but you will at the same time be saving your customer \$1.25 on the job.

At this rate you can see that the Black & Decker Electric Valve Grinder, which costs you \$45.00, can be made pay for itself in about fifteen grinding jobs.

PAYS FOR ITSELF IN THIRTY DAYS

One Cadillac Dealer has written stating that his Black & Decker Electric Valve Grinder pays for itself every thirty days.

THIS IS THE REASON

Valves can be ground with the Black & Decker Electric Valve Grinder four times as fast as by hand.

Black & Decker Electric Valve Grinders are being used in production by many of the largest Automobile Manufacturers in the United States. The Hudson Motor Car Company have ground as many as 1440 Valves in one day with a Black & Decker Electric Valve Grinder.

BRANCH OFFICES and SERVICE STATIONS

operated by factory trained
men in the following cities:

BOSTON	KANSAS CITY
NEW YORK	DETROIT
ATLANTA	CLEVELAND
PITTSBURGH	MONTREAL
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THE BLACK & DECKER MFG. CO.

Towson Heights, Baltimore, Md., U.S.A.

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BLACK & DECKER NATIONAL CREDIT SERVICE enables any reliable person in the United States or Canada to purchase BLACK & DECKER equipment on terms that will enable the equipment to pay for itself. You can purchase BLACK & DECKER equipment thru your own jobber at no extra cost for the long time credit.

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MOTOR AGE

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Entered as Second Class Matter Sept. 19, 1899, at the Post Office
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Prepare Your Customers for Spring Sell Them Top Dressing NOW

Most tops and side curtains are gray, dirty and leaky from frost and wear. All your customers need is just a suggestion—ask 'em to buy Johnson's Black-Lac now.

JOHNSON'S BLACK-LAC

The Perfect Top Dressing

Johnson's Black-Lac is easy to apply. It dries in fifteen minutes and will not rub off on the hands or clothing. It is permanent, waterproof and inexpensive. It acts as a preservative for the finest leather, making all top materials soft and flexible.

It takes no experience to use Johnson's Black-Lac—all they need is a brush and an hour's time. It gives perfect satisfaction on any kind of a top—leather, imitation leather or mohair. One coat imparts a rich, black surface—just like new.

You can make extra dollars

by giving your customers service on redressing their tops. Any one can easily do the work satisfactorily with Johnson's Black-Lac. There is a good margin of profit to the trade on Johnson's Black-Lac and every other Johnson Car Saver. Write for our book on "Keeping Cars Young."

S. C. JOHNSON & SON

Racine

Dept. MA 4

Wisconsin

"I have sold automobiles of different makes for the last seven years, and have had none that give me the satisfaction that the Oldsmobile gives, not only to me but to my owners. When I sell an Oldsmobile I can go to bed and know that I have given my owner a dollar for dollar value and not only that but he does not come back the next day and say this and that is wrong. For *out of fifty cars delivered in the year 1921 I think that \$200 would cover the service we gave on the cars delivered.* In figures, that is only \$4.00 per car. Pretty good for the dealer and for the owner."

Yours very truly,

BIG BEND GARAGE

(Exedit, Pa.)

Edw. A. Nipps

Oldsmobile
24th YEAR

If There's An Oldsmobile Dealer In Your Town—
He Is Making Money Now—Why? Because

His product is right

It is favorably known.
It comprises a complete line of
4's and 8's.
It has a wide, sensible price range
—from \$1145 to \$2635.

His franchise is right

His commissions are liberal.
He has the General Motors
Extended Payment plan to
help him.
He is given real help from the
factory.

His future is assured

Back of him is the Olds Motor Works
which for 24 continuous years has
manufactured automobiles.
And back of the company is the
General Motors Corporation, the
strongest in the automotive industry.

*If some other far-seeing man isn't the Oldsmobile
representative in your territory, why shouldn't it be you?*

OLDS MOTOR WORKS

LANSING, MICHIGAN

MOTOR AGE



Tourists and Clubs as Source of Dealer Profit

***T**HE Season Is Near at Hand When the Car Owner Will Roam Far Afield With Money in His Pocket. Serve Him Well and Organize Him to Serve Himself Well and You Doubly*

By CLYDE JENNINGS

A GREAT many dealers regard the tourist and the automobile club as a necessary evil.

Instead of this view, the dealer should look upon the tourist and motorist organizations as the rainbows he heard about as a child and should conclude:

That if he follows in the wake of this rainbow to the end, he will find a pot of gold. But there is this difference:

There were no profits along the way for the childish hunters of the pot of gold while:

The dealer will begin to profit the moment he becomes interested in either the tourist or the automobile club.

Touring is the great objective of a very large proportion of the buyers of motor cars. We are told by the trustworthy statisticians of the industry that more than 33 per cent of the cars are owned by farmers. The farmer is the greatest natural tourist in the world and he fairly revels in touring when he gets a car. He does not always call it touring, but the city man who



There are profits in supplying the automotive needs of the family on tour. Anything that will promote comfort and utility will find a ready response

drives so far from home that it is necessary for him to stay from his flat overnight, calls that touring, so why should not the farmer call many of his trips touring. In fact, many of these farmer car owners cannot go much of any place without making what folk reared in a different environment would call a tour.

But never mind about the definition of touring—it means primarily a car owner who is away from home. Most often he is away from home on a vacation trip or a business trip.

If on a vacation trip, he is in his best spending days of the entire year. He has in his pocket the money he has been saving for this one carefree, pleasure-seeking event. He probably has bought a good many things for this trip, but the chances are that he will buy a lot more while on the trip. He has the money, he wants to be comfortable and he wants to get the most out of his car.

"Selling Transportation"

To sell this man a car and then not help him prepare for this trip would be a good deal like a railroad selling a man a ticket and then not running any trains for him to travel on.

The railroads know the value of the tourist and they are making a brave fight to keep him out of his motor car and on their trains. They make a special rate for the tourist and they build great hotels to accommodate him; they serve meals to him below cost to keep him contented and they supply folders, guides and special agents to be sure that he sees the sights over the routes and that he does not lose time unnecessarily. In fact the tourist is boss of the passenger department of the railroad.

And the automotive industry likes to talk of itself as a transportation industry and we dealers like to say that we are selling transportation.

And then we want to forget about our passenger as soon as we sell him a ticket.

Is it good business?

A few years ago a St. Louis dealer, then selling a car that was not very well known—compared with other cars—organized a week-end bureau for his owners. He employed a man whose duty it was to select a resort and to make arrangements for his tourists at a special party rate and to arrange

a regular picnic program for which inexpensive prizes were provided.

On the day of the excursion, a pathfinder car was provided and a trouble car made the trip with the tourists, carrying a few tires and other emergency repair equipment, such as spark plugs and minor, but necessary, equipment.

The maintenance man who was in charge of the trouble car was specially trained for this job and well paid for his time. His special assignment was to talk with every person who would talk with him about this particular make of car and to seek an opportunity of talking with owners whom he observed to be abusing their cars.

This dealer has said that these week ends were the best and cheapest advertising he had experienced.

This same man had a touring parlor in his dealer establishment and he sent notices to his subdealers and others interested, telling them of this parlor and suggesting that they say to any Runwell tourist that he would be welcome and that information about the city and roads would be supplied him for the asking.

This did not by any means prove a charity venture, for the man in charge proved to be an excellent salesman for the maintenance and accessory department and, because this dealer was not interested in selling touring equipment, this man had a nice side line in selling tourist supplies for a department store.

Extent of Touring

Touring has become a great national summer diversion. There are more than 120 free camps in Minnesota and the number is growing daily. More than 80,000 tourists stopped at these camps last year. Almost 20,000 cars were parked in these camps for an overnight stay. Fourteen thousand cars were registered in the Minnesota State Forest.

This is just one state!

Think how many more tourists went to hotels, yet they traveled in cars and spent money!

Chambers of commerce and other lines of business men think well of these camps and these tourists and sources of revenue.

One automobile dealer wrote to *MOTOR AGE* last year protesting of these camps. He said that they opened a field for temporary establishments "gymps," etc. He was asked if

he had placed an advertisement at the camp announcing his special facilities for work on the cars he sold and welcoming the tourists to his legitimate establishment. Also, if he had put in a wash and grease rack where cars could be handled with efficiency as to work and time. Although he urged quite strongly the passage of special laws limiting the activities of these camps, he has not yet supplied these facts.

There was quite a flourishing camp near a large city last summer that accommodated a number of tourists, and there was not a single automobile dealer sign in the place. There were no facilities except those provided by the camp committee. Not a single dealer in that community appeared to care a particle about the work or supplies that an average of 100 automobile owners a night would naturally buy.

There were a score or more of automotive establishments within a half a mile of that place, and not one of them displayed a sign that welcomed the tourists.

But the department stores were not so backward. A grocery store had a booth on the grounds, for which they paid real money for rent, and kept a man there morning and evening to take orders. Several peddlers invaded this camp each morning and sold small automotive equipment to these tourists. A greasing and a wash rack within the camp frequently worked a night force to a good profit.

Dealers Ignored It

But the legitimate dealers ignored it!

Honestly now, what would you figure the loss of this group of dealers who made no effort at all to get any of the work that an average of 100 strange cars per night might have brought to them.

An automotive dealer who went touring last summer learned this lesson by observation. He was on a pleasure trip, pure and simple, and he followed the main traveled tourist highway. When he got home he wrote an indignant letter to *MOTOR AGE* on the neglect of the automotive merchandizing opportunities. In a drive of 400 miles on a prominent highway, he was not only not asked to buy anything when he was forced to stop for supplies, but he did not see a single sign that invited him to stop. He felt as if he was an unwelcome foreigner in this country.

A distributor who has 45 dealers for a popular car in a district much frequented by tourists, said the other day that less than half of these dealers had signs that informed the public that they were dealers in this car, and consequently experts in maintenance for this car.

An owner of one of these cars stopped in a town where one of these "ashamed-of-himself-and-his-car" dealers operates

and tried to buy a tire of a rival establishment. They did not have his size and calmly told him no one in the town handled that sized tire. He drove past the establishment of the dealer in his car to get this information!

"For Better or For Worse"

Very few dealers—or factories either for that matter—appear to have grasped the idea that they are selling cars "for better or for worse until the junk man do us part." Some otherwise good dealers appear to think that they are responsible only for the Runwell cars they personally have sold and they treat the stranger who drives up in a Runwell as though he carried a sign "unclean."

No matter how good the service may be that you extend to your own customers, they may become disgusted with the car when they cannot get service elsewhere, and when they are in the market for a second car they will buy some other make because they believe that they can get service everywhere on it. One great feature of the automotive business is that you cannot keep your merchandise in your own district, all of the time.

If you want your own customers to stay sold on your car, the only thing you can do is to do your part in keeping everybody who drives to your door sold on the car that some one else has sold to him. If you do your part, and the other dealer does his part, eventually you will establish a national reputation for your cars and then the man who drives outside your district will be a booster and not a knocker. A one town reputation does not amount to much for a motor car.

Recently a New York tire man was asked why he did not make his western trip in his car. He replied:

"Unfortunately I bought a _____ car. It is fine and dandy for Brooklyn and Long Island, but when I get away from there, I am up against it. Last fall I went over in Jersey and needed a little work done. I drove up to a garage and the man said 'I'll do the best I can for you, but that wiring puzzles me. I asked the _____ people for an instruction book but they refused to send it to me. They want their cars repaired in their own shops. The nearest shop they have to here is in Jersey City. That is 50 miles.'

"That finished me," said the tire man. "I have been looking for a trade ever since, but the rest of the world appears to be wise."

(An inspection of *MOTOR AGE* files reveals that this company has never supplied to this publication any of its real service information. Only a few makers do not.)

Put yourself in the attitude of welcoming tourists by invit-



A set up of things that the tourist will need along the lines of the above will repay the dealer or garageman in generous sales

A well ordered accessory case which invites the more careful attention of the casual observer and which is likely to result in sales where the less careful case would offer no attractions

ing them to your place so that the "gyms" will not get the business and disgust them with your town.

Advertise freely what car you serve and be sure the stranger gets fair treatment.

"Ask 'Em!"

Ask every visitor if he does not need a luggage carrier, a tire or some other merchandise.

The way to do this is to look over his car and see what is lacking.

Have information handy that will be helpful to him in reaching the next stopping place and tell him who is the dealer there and how he can find him.

Sell him everything that you can but give him a fair price.

And here is something that is a bit out of the ordinary!

If the car you are selling is an assembled car, list the units that you have special facilities for serving.

Nearly every owner of an assembled car knows what units it contains and if he sees on the sign that his sort of axle is serviced in this shop, he will welcome it.

Last fall an automotive man was driving through Ohio in a car that was not at that time sold in that state. The car is very similar to one that is quite popular there. This owner was having some trouble and drew up to the establishment of a dealer in the popular car. The maintenance man looked rather doubtfully at the car, as the owner was telling his troubles and began an alibi about their being specialists, etc., when the visitor caught the drift, named the parts in his car and all was well instantly.

More Than a "Welcome" Sign

He was made as welcome as if he had bought the car there. The hitch is right here:

Not many owners know other cars as well as did this man and will not know where to go. So why not a sign like this:

Specialists in:

Violet Axle
Indigo Transmission
Blue Clutches
Green Engine
Yellow Tire
Orange Starter
Red Universal Joint

Such a sign will be like an oasis to many a tourist who is lost in the desert and who has been warned everywhere of gougers and of men who do not know their business.

Had you ever really given serious thought to the fact that the maintenance business is bigger than the manufacturing business and that it is really founded on the cars that are two or more years old?

The future of the maintenance end of the business is brighter than any other branch, for it must develop to keep up with the cars already in the hands of the owners.

It is time that dealers everywhere were realizing this and were cashing in on the business that passes their doors daily.

"Ask 'em to buy" has been sort of a magic phrase this year, why not get busy with your signs for this summer.

Benefits from Motor Clubs

Now for the other part of the subject of this article—The Automobile Club.

Richard H. Lee, who has had several years of active experience with motor clubs, recently said:

"Automobile clubs grow because they serve the motorists, and when they increase their service they grow faster. Automobile clubs that function properly operate not for profit. All their money goes back into the pockets of the motorists in the form of service. Only such automobile clubs will survive. They will eventually drive out those which are operated for profit."

Now we will leave it to you:

Will not any organization that will serve the motorist as above described also not doubly serve the dealers?

Let us put the question this way:

Will not any organization which serves to make life pleasant for the motor car owner promote the dealers' business?

Still another question:

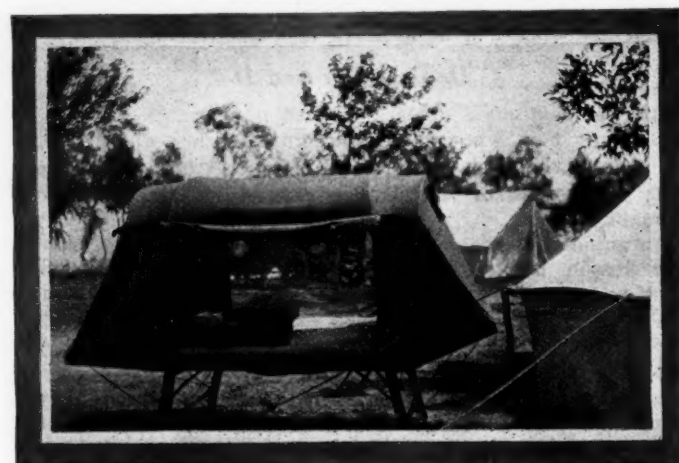
Where can you get service as cheaply for your customers as through a motor club?

Promoting Dealers' Business

There is a great future for the motor clubs, if the future is directed by reasonable business men who know the objective. Too often in the past the motor club has been promoted by a grafter or a politician. It has been used for personal advantage only. The automobile dealer as the most interested party has to a very large extent ignored the club.

Recently more and more dealers have seen the light and are taking an active part in such organizations, causing the club to take such steps as the dealers, who are, or should be, advanced students of motoring, believe to be best for the motorist.

Study closely the removal of restrictions on the use of the motor vehicle and see what the story of your community has been.



The automobile tourist makes camp for the night. A camp with hundreds of cars every night presents virtually a new city daily of a thousand needs

There were once laws which restricted motor cars to horse speed. In some communities the motor vehicle was barred entirely.

Who brought about the removal of these restrictions? Certainly not the dealer. The dealer has always been rather helpless when he appeared in public on behalf of motor legislation. He was accused of seeking changes in laws solely because of business interests.

The successful promoters of better laws has been the motor club members, the owners of motor cars who wanted better laws for personal reasons.

It is true that there was a time when dealers were active in club affairs, but that was when there was more or less novelty in the ownership and use of a car, but since the dealer business became a real business, the pioneer dealer—who was an adventurer at heart—has given way to business men who are apt to think they have too much automobile interest during the day in business and that they are not interested in the motor club.

The Potential Market

There are 10,500,000 cars and trucks in this country and probably more than 7,000,000 of these are owned by individuals. These 7,000,000 with their husbands, wives, grown children and influence are probably the largest group in this country that is interested in any single phase of legislation aside from taxes and education.

It was a knowledge of this fact that recently kept Congress from putting 75 per cent of the soldier bonus payments in the form of taxes on the automotive vehicle. The protest was voiced through the A.A.A. and the Farmers' Union. If for

no other reason than such an accomplishment than this, the dealer should lend his support to the club movement.

But clubs work along the lines of better

Traffic conditions
Parking regulations
Garage standards
Maintenance practices
Insurance rates
Highway legislation.

All of these items are developing into important sales resistance and any move that helps to correct them should be greatly encouraged.

There is the opportunity in this country for a splendid and powerful motor organization. Those of you who are familiar with the workings of the English motor clubs know what such an institution can become. That is and should be the objective of the combined motor clubs of this country but they need intelligent guidance to reach this goal. The dealers of the country should do a large part in supplying the wisdom required.

Maintenance Divisions Throughout State

Some more or less local clubs already have taken a long step in this direction. The Waterloo (Iowa) Club has worked wonders in this direction. This club has an approved maintenance division in almost every town in the state. In addition to guaranteeing the work of these maintenance stations, for stated branches of the industry, this club also guarantees payment of the bill on the part of any of its members. It is said that a member of this club can tour the state without a penny of ready money and never be questioned beyond his credentials as a club member.

This club also has established an information department as to odd tire sizes. This question is becoming a serious one for owners of older cars and this feature has been well worth the cost to some members.

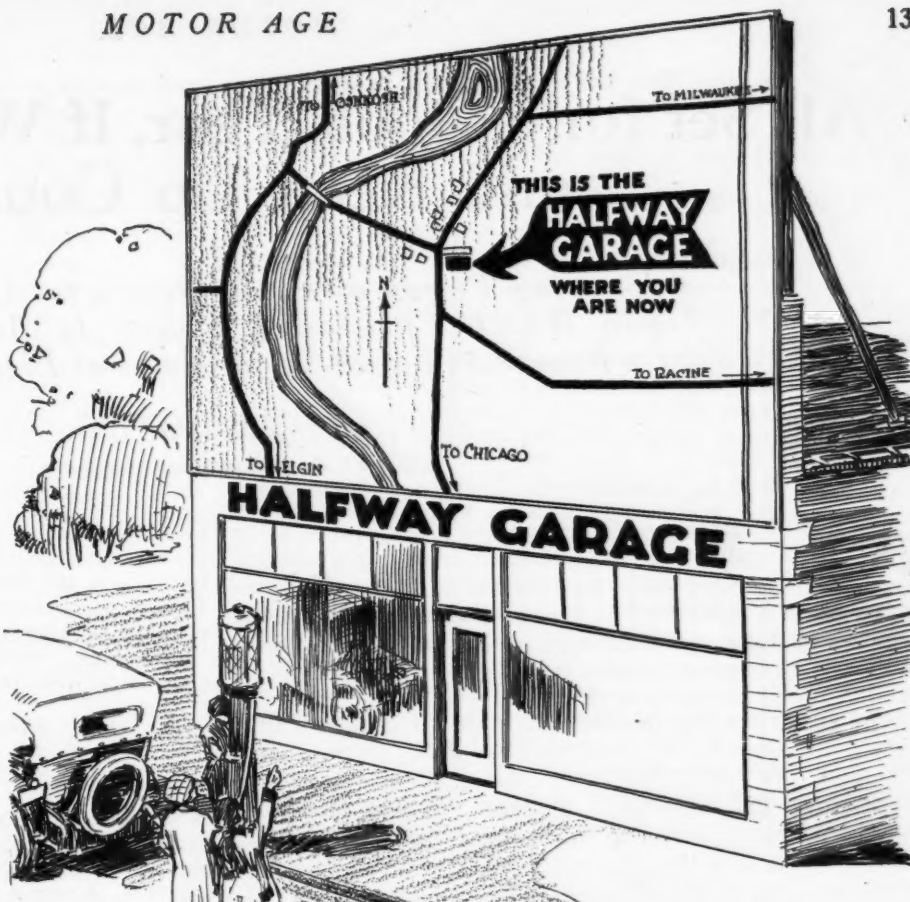
The club has a day and night service for its members during the touring season and a telegram or a telephone message from any lost or stranded member brings instant relief anywhere in the state. Also such a message brings instant assistance in case of arrest. The service points out the places where motorists are preyed upon by unfair officials.

This club is approaching the goal that should be before all motor clubs and every dealer in the country should get busy to see that the club in his community is doing its part.

Any dealer who takes part in promoting this kind of service for motor car owners should realize that he is making a better contented body of owners and that all of his customers will share in the results. He should realize that in doing this work he is going to meet a great many prospective car buyers and that these prospective buyers are very likely to look him up because they realize that he is interested in them beyond merely getting the money for his car.

Support of the club and tourist movement should be immediately profitable to those dealers who conduct a storage garage business in connection with their dealers and service business. The storage rate in most of the smaller cities ranges from \$6 to \$10 a month, according to the accommodation and the size of the car. A flat rate of 50 cents a car a night is a considerable profit over the regular rate for selling garage space.

One of the chief problems in getting the attention of the tourist and club member is that of a proper sign to attract the driver. Motor car passengers frequently miss the window and other flat signs. It is practically necessary to erect a sign that projects from the building, over the sidewalk or



This idea was suggested to MOTOR AGE by E. M. Brookens of Winner, S. D., who sent to this office a photograph of his establishment, which has such a treatment of the front. Owing to a last minute accident, this photograph was impossible of reproduction and the drawing is substituted. The novel sign has served Mr. Brookens well in a trade way

some similar arrangement. The sign must be seen before the motorist reaches the building to attract him. A sign that often catches the eye is one on the side of the building. This is especially good if the building is on the corner of a street or even at the corner of an alley. One dealer who is just off the main street of his town has found it necessary to erect a sign that can be read from the main street.

The best possible method of reaching the motorist is, of course, signs along the main highways leading to the town.

A number of dealers in prominent tourist centers have found a wall map of their vicinity of great value. This map usually hangs in the garage at the point where the tourist receives or leaves his car. The best form of map is one on a roller that is kept under cover except when in use and is always clean and presentable. These dealers also sell road maps of their vicinity. The source of profit from such sales are not large, but the appreciation of the service by the mapless tourist more than compensates for the trouble of handling them.

There is a pot of gold awaiting for each dealer who will follow the tourist and motor club rainbow and plenty of expense money for him while making the trip.

:-: :-: :-:

A Suggestion From a Tourist

A WOMAN tourist who had experienced a somewhat uncomfortable journey, in writing to MOTOR AGE on suggestions for dealers, mentions several points that are worth considering. The first desire on reaching a stopping place, she writes, is a dressing room where there is privacy of four walls, toilet facilities and drinking water. She does not ask for much space.

Then she notes the articles that her party bought in preparation for or during this tour, going chiefly to other than automotive stores for them.

Collapsible camp table
Hammock and cot
Awning to serve as bed canopy
Canvas bucket
Camp axe and spade

Trailer
Sleeping bag
Nesting cooking utensils
Gasoline stove
Folding iron stove

All Set for a Good Year, If We Work Hard and Keep Up Courage

Advancing Prices of Farm Products Are Foundation Upon Which Purchasing Power Is Being Restored. Prospects Excellent for Sales of Light Trucks

By JAMES DALTON

News Editor Class Journal Company

AFTER wading through gloom neck deep for nearly 18 months, the automotive industry has almost reached the promised land of prosperity. The life preserver of confidence was lost early in the journey and a lot of pilgrims had narrow escapes floundering around in the sea of despond. There were a good many casualties but not nearly as many as were expected.

The shore is rocky in spots but there are a good many lighthouses to pick out likely places to land. Once ashore the going isn't altogether easy and a few detours are required around obstacles in the way. A little tunneling may be necessary here and there and dynamiting may be advisable now and then to blast holes in the wall of sales resistance, but on the whole the plucky survivors will find little to discourage them after what they have been through.

Milestones mark out the road ahead. The two most important are:

Higher prices for farm products, more cash and more buying in agricultural districts.

A general increase of operations in industrial centers and less unemployment.

This tells the whole epic story of the transformation from deep depression to comparative prosperity. The country as a whole is not yet out of the woods but it is coming through.

Improvement in Past Two Months

Conditions are vastly better than they were a year ago. The improvement in the past two months has been astounding. Up to the close of January there appeared to have been little change from the closing months of 1921 and some fear was felt that predictions of general business betterment in the early months of 1922 were premature.

Higher prices for farm products such as grain and cotton wrought the change. There was an immediate increase in the purchasing power of the farmers who constitute half the entire purchasing power of the country. This reached back to the mills and factories, which took on additional workers. When these operatives went back to work they began purchasing goods at retail. This brought more orders to the wholesalers, which went back to the producers.

Thus the circle was completed. It was another demonstration of the time-honored economic law that there can be no general prosperity when any one great section of the population is not prosperous.

Watch those farmers! They're coming back. They felt for two years, with considerable reason, that they weren't getting a square deal. They accused the whole world of skulduggery against them. They couldn't get enough out of their crops to pay the cost of raising them. They owed money to everybody who'd trust them. Their creditors needed the money. In a good many cases they were having a terrible time to keep four jumps ahead of the sheriff.

The farmer hates debt. It hurts his pride not to be able to meet his notes when they're due. He prides himself on his

honesty. When he sold some wheat or corn or hogs he dragged the old automobile out of the barn, shuddered at the way it rattled and the engine knocked, pumped a little air into the decrepit tires, climbed into the driver's seat and called his wife to go along with him. He drove to town and stopped at the village bank. Then he dug his lean looking roll out of his pocket and went in to whittle down the notes again.

Increase in Market Prices

While the head of the family was paying for a fraction of the "dead horse," which might represent the seed he bought in the Spring, his wife was window shopping. She was looking longingly at the new gingham and the dresses and the millinery. Looking was all she could afford. If she bought anything, it was a pair of cotton stockings or something she couldn't get along without. Maybe they took home a bag of peanuts or candy for the kiddies. That was all except the cancelled note.

Then the tide began to turn, as tides always do. With the exception of tobacco, every agricultural product for which prices are given in the "Survey of Current Business" issued by the Department of Commerce, showed a substantial increase in February over January. Compared with December, the improvement is still more marked. The price of hogs in Chicago increased 45 per cent in two months. Sheep and lambs increased from 40 per cent to 70 per cent. Wheat and corn each rose about 20 per cent. Wool went up to 28 per cent, while cattle and the minor cereals showed substantial gains.

Although cotton is slightly higher than in January, it is below the price reached in the last quarter of 1921. While February was a shorter month than January, the daily average consumption of cotton in the mills was about the same. Compared with a year ago, there was an increase of 20 per cent in consumption notwithstanding the widespread labor troubles in New England mills.

There were fluctuations in March in the prices for farm products but on the whole they were high enough to take a good share of the gloom out of the farmer's heart. He always is happier in the Spring anyway, when he can get at his planting. But he is a lot more cheerful this Spring than he was last. It begins to look to him as though the worst was over, that he will be able to pay his debts and have a little left to buy some of the things he wants, but doesn't actually have to get.

What the Farmer Wants

Among the things the farmer wants more than anything else, are inexpensive motor cars and light trucks. He's going to have them if he can. A questionnaire sent recently to a large number of farmers in Washington, Oregon and Idaho brought the information that more of them proposed to buy motor vehicles than anything else except supplies needed for agricultural operations. This situation is typical.

After two long, lean years, the men in the rural districts, who deal in motor vehicles, equipment, accessories and service, are going to find their business very much better in 1922. In fact, they may be better off than their city brothers.

The average farmer is going to buy something, at least, from them. And not all farmers are average. Thousands of them have money in the bank and there are many sections where they have been making some money right along. They have been disgusted at general conditions, however, and have refused to buy on general principles. Now they are convinced that the farmer is coming into his own and they are ready to go into the market.

But they must be SOLD the goods they want. It won't be enough to sit on the front porch and wait for them to come along. The merchandiser who does business with them, has got to work and work hard. They will buy where they think they can get the most for their money.

It will pay to cultivate the farmers this year. Even in the Dakotas, where they are poorer than almost anywhere else, there are prospects in every district. If the automobile dealer or service man will dig them out he can sell them something. From an automotive point of view 1922 won't be the best year on record in the agricultural sections, but it will be so much better than the last two have been that it will seem like genuine prosperity. Business will get better steadily as the year advances, reaching the peak at harvest time.

In selling automotive equipment to the farmer, it isn't necessary to sell him on the value and utility of motor vehicles. He's sold already. All he needs is the cash or credit to buy them. He will think several times before he'll buy a passenger car on credit, but if he can be shown that a light truck will lower his marketing costs and increase his profits, he will buy one on time.

Trucks of one-half, three-quarters and one ton capacity are going to be mighty good bets in the rural communities and it wouldn't be surprising if more money were made on them this year than on passenger cars. That's a market every dealer should study earnestly.

The villages of the country, except those which are close to big centers of population, are mainly dependent on the farms for their prosperity. As the farm market grows, their business expands. Even the doctors and dentists and lawyers in these towns have had to take notes from their farm patrons the last two years. With the payments made on these notes they will be likely to buy the motor cars or equipment they need.

With the village merchant selling more goods, he'll have to order more freely from the city wholesaler or jobber. These orders will move back to the mills and there will be more work in the factory towns.

For example, when a few farmers in North Dakota sell their goods at what they think is a fair price they may decide to buy sewing machines for their wives. If they do, it may be a big help to Elizabeth, N. J.

It is easy to see, therefore, that the automotive dealer in every part of the country is going to be helped by higher prices for wheat or pigs or eggs.

Leading in Process of Readjustment

The United States has gone far in its readjustment from a war to a peace basis. That readjustment never can be finished completely until the rest of the world gets back to par, as it were. A long time must elapse before that much desired condition can be achieved but steady progress is being made in that direction and it is more rapid than appears on the surface.

Full prosperity never can be restored in this country until foreign countries can absorb the surplus of raw materials and manufactured products which the United States can produce. That makes all the difference in the world so far as profits are concerned. But the export market is improving rapidly. The American manufacturer of motor vehicles and equipment who is going after export business intelligently is getting it. The increase in the value of the British pound sterling has helped amazingly.

A lot of things remain to be done in this country before normal conditions can be entirely restored. Some of them are:

Sane revision of the tax system.

Reduction of governmental expenditures.

Permanent settlement of the tariff on a sane basis.
Reorganization of Federal machinery so it will give more efficient service.

The refunding of foreign loans so they can be reduced gradually.

Assistance to exporters and the safeguarding of foreign commerce.

Assistance to the farmers through supplements to the normal banking machinery and by the mobilization of private credit to finance cotton, cattle and other commodities.

Development of water power resources and the elimination of waste in production and distribution.

Legislation never can be a panacea for economic ills but wise action by Congress will do much to solve some of the pressing problems.

The business world already has done much to right itself and the readjustment has come about with less disturbance than might have been expected. There has been no actual money panic as there would have been except for the Federal Reserve system and as there always has been in previous periods of great depression.

So far as the automotive industry is concerned, it has been exceedingly fortunate. The percentage of casualties has been relatively light. Failures there have been, but they have been comparatively small and they have not shaken the structure of the industry. Last year was the third best the industry ever has had and this year will be fully as good. It will be considerably better except, perhaps, in the sale of passenger cars. The total in that field is not likely to go much ahead of last year, but it must not be forgotten that more than 1,500,000 cars were sold in 1921.

Manufacturers Want Competent Dealers

Factories are cooperating with dealers as they never did before. They are considering the questions of finances, used cars, service and satisfied customers. They are thinking in terms of quality and their engineers are working on mechanical improvements. Greater mileage per gallon of gasoline and lower maintenance costs for motor vehicles have become mighty big factors. Keen competition is a business stimulant.

Manufacturers are competing for competent dealers. They are glad to make contract concessions to get the right men and they are looking at the vital problems of the industry in a broader way. They realize that all its component parts must be prosperous and happy if it is to be happy and prosperous as a whole.

Builders of motor vehicles have liquidated their inventories and taken their losses, staggering as they have been in some cases. They have done everything possible to lower production costs and overhead expenses. The consequence has been that they have been able to make drastic price reductions. These reductions have been passed on to the ultimate purchasers and they have not been absorbed by the middleman as they have been in most other industries. As a result purchasers have no grievance. Even the farmers admit automobile makers have been fair on the question of prices.

Prices seem to have been fairly well stabilized in the passenger car field, although reductions may be expected here and there throughout the year. Truck and tractor makers have brought their prices down as sales have felt the stimulus of improved business conditions generally and competition has forced them to act.

The hearts of the great basic industries are throbbing with a stronger beat. Idle freight cars are rapidly decreasing in number. Bank vaults are bulging with funds awaiting investment in sound enterprises. Interest rates are going lower all the time. The nation finally has conceded that motor vehicles are essential to its life and that even passenger cars are not "pleasure" vehicles.

There are a few clouds left on the automotive horizon but the sun has broken through and there are big patches of blue sky. The automotive merchant who whistles as he works and who works hard will have a good year and when he balances his books at the end of December he will find he has prospered.

The Dealer's Big Job Is to Sell

therefore

The Dealer Himself Should Sell If He Would "Cash In" on Himself

Jim Levy, still a master salesman, gives his views on the present and future of the motor car merchant. No use apeing the drygoods man

James Levy told this story:

THE other day I went down the street to see one of the boys about a committee meeting. When I went into his store I found him on the floor selling a car, so I nodded, said I would be back in a few minutes and went on my way. When I returned, he said:

"Aint it hell when the boss has to go on the floor and sell cars?"

"I should say it was hell when the boss don't go on the floor and sell," was my answer."

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A few days later Levy was at lunch with members of the Chicago Automobile Trade Assn. when a telephone call for him was announced.

"Some one wants to buy a tire, Jim," and similar good natured jibes greeted the call, but after his departure this conversation was heard:

"Jim probably sells more cars than any man on his force," said one dealer.

"He probably sells more cars than any salesman on the street," said the dealer next to the first speaker and this verdict was pretty well agreed to.

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So it would seem that Levy has a different idea of business than most motor car dealers, at least most of those in Chicago. He is probably the biggest Buick dealer in Chicago and there are 23 of them. So he was asked to set forth some of his ideas as to the dealer and what he should do. What follows is informally quoted from a conversation with Levy:

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My idea of it is that it is a dealer's business to sell motor cars. That is his one big job and really it is the only thing he has of importance to do.

So, if the big job is selling motor cars, why not sell them. The biggest job in the place is the job for the boss. Selling is the biggest job in the dealer's establishment, so it's his job.

I never do anything I can hire any one else to do as well as I can do it. So I hire the clerical work, the book-keeping, the mechanical work, the sweeping out done by people who can do it better than I can.

I went into this business because I

could sell. I am a better salesman than I was when I went into this business, consequently I do as much of the selling as I can because I can do it better than the men I can hire.

When the boss sells the new cars it requires a lot less thought in financing the business than when he leaves it to the young men he hires. A part of the time I put in selling is saved from the time I would have to give to financing, if I didn't sell the cars myself.

Inspection of the cars offered to us in trade is another of my jobs. Here again I save time that would be needed to finance the business if I did not know why the money was going into the used car.

The salesman only works for me when he is selling the new car. That part of the job done, he turns around and works for the customer to complete the deal. He is then trying to sell an old car to me. I buy these old cars myself with a view of selling them again.

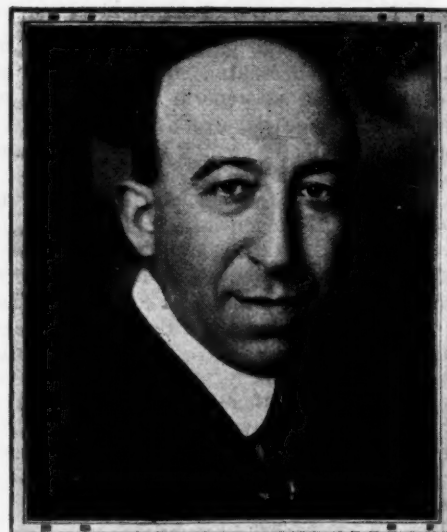
The passenger car dealer should have very little office work. He knows what his cars are going to cost him, when he must pay for them and that should be his only financing proposition. He is not like the merchant who has to shop around and "buy right."

We have cut this business too much on the pattern of mercantile business that is not like ours. We sell goods in large lots.

How many sales does the department store that sells a million dollars a year have to make? A million dollars is not a great annual business for a motor car store. In some stores that means one sale a day. Go into any department store and announce that you are going to spend \$3333 and the president himself will come out to greet you and see that you are well cared for, despite his many routine duties in a business of great detail.

In many of our stores, a youth who would be a junior at the neckwear counter will greet that customer alone.

The motor car merchant must give more attention to his salesmen. I never employ a man who cannot make himself prosperous. My customers all have proven themselves successful or they would not have the price of a car. It is folly to send to meet them a man who



JAMES LEVY

is wondering how he is going to pay his next month's rent. He don't stand a chance.

Really I do not sell as many cars as I help to sell. I like to be in on practically every sale. I like to know what the salesman has told the customer. The way to keep a car sold is to sell it right in the first place.

If only good and true statements are made for the car when it is sold, keeping it sold is merely organization. A good executive can handle the maintenance department. The time slips, requisitions and other data permit you to keep a check on repair charges. If you are on the floor constantly, you have an opportunity to hear all complaints and to adjust them.

Be sure your salesmen look as good as your cars. Recently I sent two men to the used car department because they looked and talked like used cars. They are successful over there.

I see the day coming when the sale of new cars will balance the expense of the business and the dealer's real profit will come from byproducts. Tires, accessories, maintenance, insurance, used cars and all of these things that you can sell to the customer you found by means of having new cars for sale will mean much to you. The car will be the meal ticket, the byproducts the profit.

Tests of fuel tanks entered for the Air Ministry competition for safety tanks for aircraft commenced at the Royal Aircraft Establishment on Dec. 5. The object of the competition, for which prizes amounting to £2,000 are being offered, is to obtain a tank that will withstand the shock to which it may be subjected in an airplane crash without either bursting or leaking, and thus eliminate almost entirely the possibility of fire in such circumstances, and will also withstand the effects of enemy action by machine gun and shell fire. The competition brought in 26 entries.

Making Maintenance Pay

SEVEN Essential Departments Into Which Maintenance Division of Any Dealer's Business Can Be Divided. Selling the Customer and Delivery of Work Important Points to Watch

BY B. M. IKERT



The most important thing in maintenance is the handling of customers. Future sales are made or lost by the manner in which a customer is treated and sold on the company's policy. Getting to know each customer personally is a big step forward in making maintenance pay. Here is shown Service Manager Hoffner, of the Hudson-Frampton Co., St. Louis, chatting with a customer about his car.

EVERY automotive dealer's maintenance division can be subdivided into seven departments. This is true whether the business is large or small. It is true also that there may be instances, especially in the smaller establishments, where two or three of the departments may be combined in a single unit. Thus, in a small business establishment we may find the quick service department and the department for storing completed cars combined. Or the shop proper, that is the point at which the machine tools are located, may simply be a portion of the repair shop floor and not a separate room.

No matter if two or three or a hundred cars are worked upon in a day the work involved from the time the customer drives in until he takes the car from the maintenance department, there must be just so many

operations involved during the reception of the customer, inspection of car, making out the repair order, routing the car, doing the actual work of tearing down, getting the new parts to install, reassembling, inspection and passing of the job, billing the customer, his paying for the job and your delivering the car to him.

The small institution may not have all the facilities of the larger one; it will not employ anywhere near the same number of men, but the job of tearing down a rear axle on a Runwell car will be the same in the small shop as in the larger. It may take a little longer in the smaller place and the service manager may also have to play the roles of inspector and shop foreman, but eventually the job will be finished and very much the same processes will have been gone through, in some form or other, when the customer gets his bill in the small institution as in the larger.

The volume of work handled, or the possibilities of future

work, must necessarily have something to do with the facilities for selling maintenance work properly. It determines the size of a building, its arrangement, equipment and personnel. The large maintenance building may employ two or three bookkeepers and clerks, while the small institution may find it sufficient to have a bookkeeper working on a part time basis. But at any rate bookkeeping is essential to both places.

The large maintenance building may have an outdoor store-room for finished cars and this may be partly roofed over. Or, there may be a lot across the street used for the same purpose. As soon as a customer calls for his car a man goes over to the lot and brings the car to the maintenance building proper, or a telephone call from the maintenance salesman to the man in charge of the finished cars may bring the same results. The foregoing is true of the larger maintenance buildings. The small institutions usually cannot afford such means, nor has it the volume as a general thing.

In the small maintenance building, the cars which have been finished probably will be parked against the wall, or they may be parked at the curb on a side street. At any rate the cars will have to be placed somewhere when they are finished and the problem is there no matter what the size of the establishment.

Then there is the shop proper, by which we mean the "machine shop" of the larger maintenance building and the corner usually set aside in the small building for the drill press, lathe, arbor press, etc.

Equipment is going to vary in proportion to the size of the shop, yet it is not common to go into a comparatively small maintenance building and therein find equipment which outdoes that in a building twice its size. Many of our larger maintenance buildings have not as yet learned the value and great importance of installing plenty of good equipment.

No maintenance department of any dealer's business can afford to get along without certain labor saving devices. Not only do they save time and labor, but very often insure a much better job than hand labor affords. So, whether the maintenance division handles five or a hundred jobs a day, equipment must play a hand somewhere in the main repair shop.

It is possible to go on as in the preceding paragraphs and point out that no matter where maintenance work is carried out, in a large or small building, on a large or small scale, there must be certain things and operations common to both. The small building can learn from the larger and well put into effect some of the things which have been tried and found satisfactory.

The Departments of a Maintenance Division

While we probably never shall divide sales and maintenance so far as the dealer is concerned, we reasonably can expect to see many dealers housing their maintenance division under a separate roof—entirely away from new car sales. Many are doing this now. The small dealer will have to content himself with keeping his maintenance department at the rear of his building. Even so, he will divide his sales and maintenance so that each has its own supervision, records, etc. In other words maintenance has grown to such an extent that it must be handled as a separate proposition. It is a business in itself and only as he makes a business of it will the dealer succeed and make maintenance pay a profit.

As long, then, as maintenance is a business, it is possible to analyze it. The reader must bear in mind that we are speaking of maintenance on passenger cars only. The same kind of work on trucks and tractors brings about factors that do not enter into passenger car maintenance and must, therefore, be treated in a different manner. In another part of this issue we treat on the subject of truck maintenance.

In subdividing the maintenance division of a dealer's business we find that there are seven major departments. They will not always exist by themselves, nor can we speak of them always as a "department." For example, the selling of service is a division by itself, but is not as tangible a thing as the parts department. Yet every institution, large or small, will have some form of selling its service and it is one of the most important factors with which those in the maintenance end of the industry have to come in contact.

The seven major departments of maintenance are:

- 1—Maintenance Sales.
- 2—Quick Service.
- 3—Main Repair Shop.
- 4—Parts Department.
- 5—Finished Work Storage.
- 6—Delivery Department.
- 7—Accounting Department.

These have not been arranged as to their importance. All are necessary and every dealer or manager of a maintenance division will find them existing in his own establishment. We have put "maintenance sales" at the head of the list, however, because it is the most important of all. The best job of repairing in the world will go wasted if the owner of a car leaves the building in a bad humor. The selling of maintenance bears on every other department of the business. It is far reaching. It bears upon such things as providing shower baths for the men in the shop, giving them a clean suit of overalls each week and letting them have a cheery spot somewhere in the building where they might eat their lunch.

1—Maintenance Sales

THE selling of maintenance, we have said, bears on every other department. It takes in the reception of the customer upon his entrance into the building. It takes in the inspection of the car, getting the owner's consent to the work that must be done, tagging the car, routing it to the shop, getting the parts and materials needed, keeping record of the mechanics' time slips, making out the cost sheets, billing the customer, caring for his car when it is completed and awaiting the owner's arrival, his payment of the bill and the delivery of the car to him.

It does not stop there. The customer must continue to be sold on the services which have been rendered. On a large job there should be a follow-up to ascertain the status of the job. A customer may be dissatisfied a week after the work has been done and if he can be caught in time he may be made to change his mind before it is too late and he is lost forever not only as a customer for the maintenance department, but as a new car sales prospect.

We have known of cases where a man has bought a medium priced car to take advantage of the dealer's excellent manner of selling his maintenance, when he could have bought a car costing twice as much. The trouble with the dealer selling the higher priced car was that he did not understand the fundamentals of keeping his buyers satisfied, nor did he establish the right kind of maintenance relations.

Selling maintenance means that the customer will be treated with courtesy and given attention the minute he drives into the maintenance department. It may mean only telling him to please wait just one minute and he will be taken care of, or something similar. He drives to the maintenance department chiefly because something is wrong with his car and he is very often in a state of mind where if he is not given attention he will get pretty mad.

The successful maintenance stations have observed this and as a result we find in them a salesman or inspector perched very close to the entrance, so that he can nail a customer just as he stops his car. The initial contact with the customer is one of the most delicate problems with which this end of the business has to deal. You either get a man's good will, or you build up resistance. In plain English, you make money or lose it.

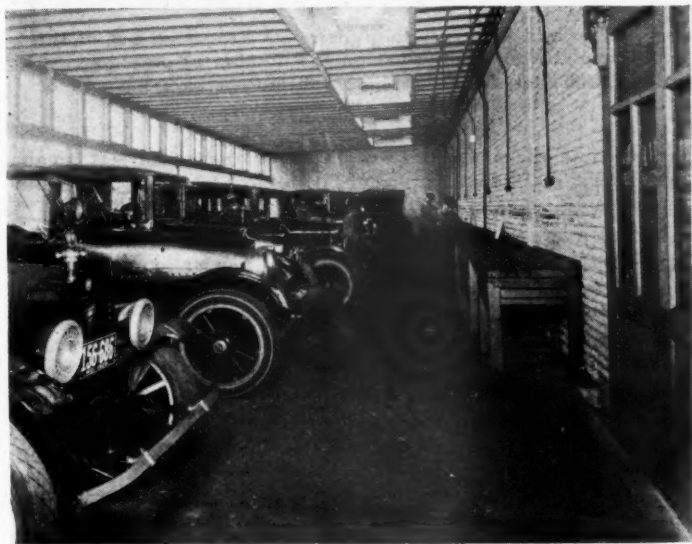
The right way to sell maintenance includes that when a customer leaves the building he has a thorough understanding of what is going to be done to his car. He may have had an idea of what he wanted done, but his diagnosis of whatever trouble he may have had with his car may be altogether different from that given by the inspector.

Suppose a customer says, "My engine knocks, it's carbon, so burn it out." He may have read at somewhere that carbon

makes an engine knock. Any kind of a knock to him means carbon. Suppose the shop takes his word for it and burns out the carbon. He may have loose connecting rods. He drives the car away and the same knock is there. The rest is easy.

If maintenance is sold right, provision will be made whereby an owner's diagnosis is not the final one. In the above case, an inspector should have listened to the knocking in the engine and told the man that primarily his engine needed tightening up, with the possibilities that new bearings might be needed, the crank pins trued up, etc. He must be made to understand that several things may have to be done before the job will run the way he thinks it ought to run.

Selling maintenance takes in the signing of the work order by the customer. It means making out in duplicate or triplicate as the case may be of the repair shop order, tagging the car properly and making out such things as a "history" card for the particular car. It takes in the delivery of the car to the owner, his payment of the bill and sending him off happy. It is without doubt the biggest factor in the business and can be merely touched upon in an article of this kind.



Handling jobs which require an hour or less in an outdoor shop equipped with benches, jacks and necessary tools will get customers' cars under way in minimum time and keep the main repair shop for the more complicated forms of maintenance work

2—Quick Service

MANY will probably ask why we make the quick service department a division of the maintenance department. We do this simply because a quick service department has proved to be of economic benefit to both dealer and car owner. A large institution will have a section of its building divided off for a quick service department where all jobs requiring an hour or less are handled. A small building may not have a separate room for its quick service, but have part of the main repair shop set aside for the work.

The point is this: there will always be owners driving in who want work done which requires only a few minutes to perform. It would be poor policy to say to such owners, "Just leave your car, we can't do the work now, but you can have the car in a couple of hours." Suppose a doctor driving to his office stops and needs a spark plug cleaned. He gets it done by virtue of the quick service department. Many small dealers probably do not call it a quick service department, but the chances are ten to one they have one just the same.

It pays a large maintenance department many times over to install in its quick service department, work benches, vises, etc., entirely independent from the main repair shop. The men in the department, also, should be those thoroughly experienced in this class of work, because the big point is to get the customer out quick and not sacrifice good work. The

quick service department keeps the smaller jobs out of the main repair shop.

In this department, also, are handled such instances of free service as generally go with the purchase of a new car. Thus the 30-day inspection which many dealers extend to their customers might well come under the jurisdiction of this department.

No jobs of tearing down any of the units are undertaken in the quick service department. It is primarily a department for adjusting and carrying out those operations wherein little or no machine work is necessary. It will include adjusting valves, setting carbureter, ignition points, tuning engine, adjusting brakes, taking rattles out of doors, hood, and similar items.

Although not a part of it, the quick service department will see to it that a customer is properly cared for while his car is being worked upon. He may prefer to sit in the car, but a rest room goes a long way towards making a hit with him. More so, of course, if the customer be a lady.

The quick service department will handle jobs as the main repair shop does when it comes to making out a work order, etc. In the past many of these quick service jobs have been given gratis because they were thought insignificant. One of the surest ways to make maintenance pay is to put the quick service department on a proper basis. Not every job need be charged for; it would be folly in some instances, but no job is too small to be not well handled.

3—The Main Repair Shop

AND now we come to that division of maintenance which many dealers are wont to call "the shop." Physically it generally is the largest department of the maintenance branch. It may embrace many other "shops" such as the blacksmith shop, the machine shop, paint and trim shop, tire department, battery department, laundry or wash rack, oiling rack, etc.

In order to make maintenance pay, care is necessary in laying out and equipping the main repair shop. Experience seems to indicate that the best plan to follow in planning the shop is to locate the various units in such a way that there will be minimum loss of time in handling any sort of the work. For instance, the engine overhaul and axle overhaul departments, which constantly are in need of many new parts for the cars being worked upon, should be located as close to the stock room or parts department as possible.

Another point of extreme importance in connection with the shop is the location of the foreman's desk. We are assuming in this case that the foreman is not a person actively engaged in shop work, that is, he will confine his attention only to the supervision of the work. His desk should be located as close



A maintenance department which can boast of a completely equipped machine shop like the one shown here seldom suffers from want of work. Such shops can do practically everything but cut gears

to the parts department as possible, so that when a mechanic wants a new part to install in an engine or axle, he can see the foreman, who can then pass judgment as to the advisability of a new part.

The foreman's desk should be located so that he can keep an eye on the new men. The experienced men may be located farther away from his desk, because they can work along without his constant supervision. Therefore, it is better to so plan the shop that the work which is not so particular and can be done by men less experienced, is done in view of the shop foreman, the thought being that as the men progress they can be moved to other parts of the shop where they may work largely on their own reputation.

The main shop should be laid out so that there is little or no confusion in handling the work. Nothing is so destructive to good work and shop morale than to jam a building full of cars and make it difficult for a mechanic to get at his own work. A man may be through with a car only to find it almost impossible to get it out of the shop, because of the interference of other cars.

The equipment of the repair shop will depend somewhat upon its arrangement. Naturally it makes a difference if the shop is located on the ground floor or on a floor above. Thus in a shop located on the ground floor it may not be so necessary to install an overhead carrier, because very often a good crane will be found sufficient. On the other hand if the shop is spread out over a considerable area and a large number of cars are worked upon daily an overhead carrier may be just the thing.

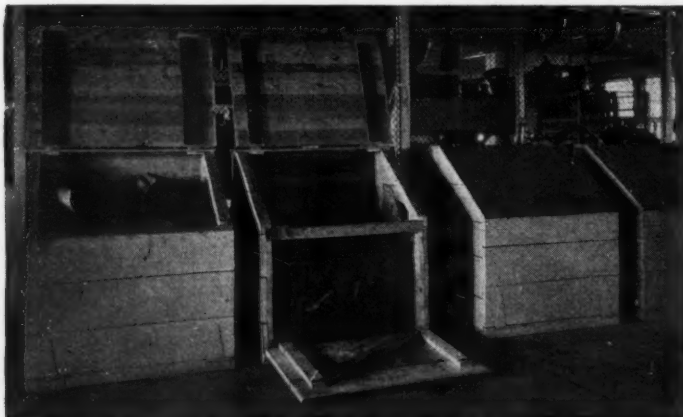
Those shops which have helped to make maintenance pay are those in which attention has been paid to good bench equipment. To handle work properly it generally pays to install a good vise at each man's bench. It should never be necessary for a mechanic to have to wait until another man gets through with a vise. Yet this is the case in many shops.

In the better equipped shops you will find that each man has at his bench a socket for plugging in an electric light, a jet with compressed air, a fire extinguisher, etc.

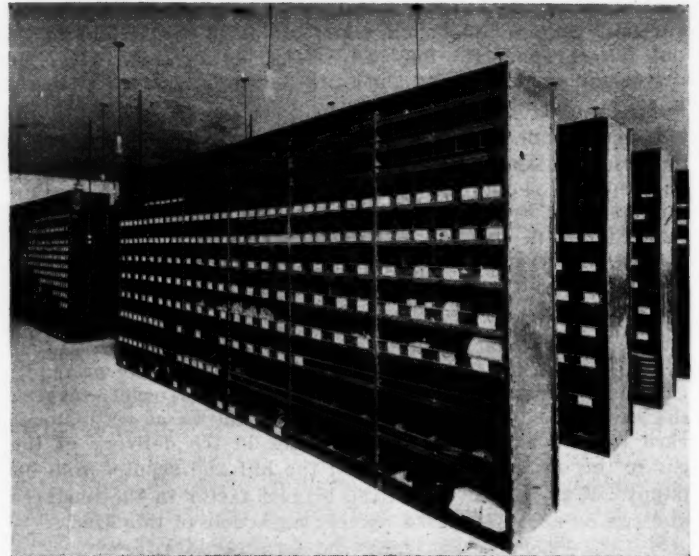
It pays in the shop to have a boy take care of picking up oil buckets, funnels, etc., to have charge of oils, greases and such materials as sand paper, crocus cloth, washers, files, alignment jigs, etc. This will prevent injury to the apparatus and also eliminate waste, because if a mechanic is allowed to help himself to emery cloth or some other shop commodity he generally will take twice as much as he needs for the job. To make maintenance pay it will help to cut down shop losses through breakage or careless handling of parts and materials.

4—Parts Department

IT GOES without saying that maintenance work on automotive vehicles takes in the installation of many new parts. There are many moving parts on a car, truck or tractor and



Those who are making maintenance pay keep a close watch on details. For example, here is shown how one company saves all its iron filings and turnings, scrap metal, etc. Besides, it makes for a neat looking shop and helps build shop morale



Just how quickly customers' cars can be gotten out of the shop will depend somewhat on the number of parts carried. The best shop facilities go for nothing if cars have to be tied up a long time awaiting parts

in due time these must be replaced or re-bushed. It means that every maintenance station will have on hand parts for replacement.

In the average maintenance department one man can take care of the stockroom. He generally can take care of the customers' wants, fill the requisition slips of the mechanics and see that the stock is kept up. **The proper handling of the stockroom is one of the important jobs in the maintenance department.** To neglect it means that some customer's car may be tied up for several days or even more awaiting the arrival of certain parts from the factory.

A good system of keeping stock room records is essential. There is no need for "red tape." Some of the best and most effective systems are those wherein but a few forms are used. Sometimes there may be but a single form.

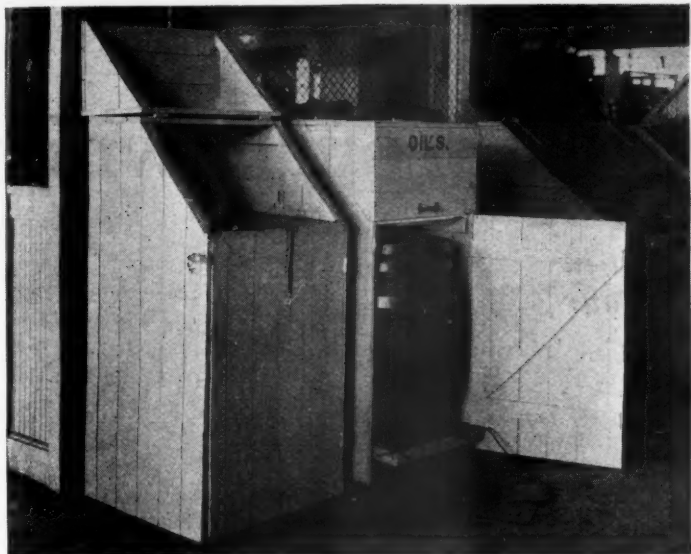
The arrangement of the stock is another point about which much might be written. The proper storage of crankshafts, camshafts, etc., is very important, because it becomes quite easy to damage such parts if not properly cared for in the stockroom. Bulky parts like fenders, radiator shells, splash aprons and similar things which are highly finished easily might be scratched or otherwise damaged if allowed to lay around the stockroom carelessly.

The deterioration of parts means a direct loss to the dealer and one of the surest ways to make maintenance pay a profit is to handle the parts department correctly. It will prevent the accumulation of obsolete parts, which so far as making money for the dealer are concerned are practically useless. The properly arranged and managed stockroom is that one in which the turnover is quite frequent.

5—Finished Work Storage

WHEN you get through with a car in the maintenance department, something has got to be done with it. Usually the customer is not right on the spot the minute the car is finished and so it must be placed somewhere on the premises awaiting his arrival.

Those maintenance departments which have in connection to their building a vacant lot can easily solve this by converting it into a storage space for finished work. The lot must be in charge of a man whose duty it is to see that no car goes out unless proper credentials are at hand. A release slip presented by the customer usually does the trick. But, we believe, a much better method of doing this and incidentally selling your service better, is to let someone from your maintenance department get the car and present it to the customer while he is in the building paying his bill.



While it may seem a trifling matter, yet the keeping under cover of such things as oils and greases and dispensing them carefully in the shop will cut down overhead and increase the chance for profits

6—Delivery of Work

IN the past, many a good job of repairing has been undone at the time when the customer called for his car. If there has been no previous agreement on the cost of the work there is likely to be a row at this time. The customer may have had visions of paying \$10 and to his surprise he gets a bill for \$30. Everyone who has had experience in this business knows what happens. There has to be an "adjustment" perhaps by the service manager. Or, if this is not possible the customer goes away angry and probably will be hopelessly lost as a future customer and a new cars sales prospect.

We pointed out at the beginning of this article the importance of selling maintenance properly. It must be sold at the start, but not allowed to rest there. The customer must be sold all the time. You may have sold him on your excellent facilities, your good mechanics, your flat rate system, your wonderful shop, but if you turn over his car to him with the upholstery smeared with grease, the steering wheel rim or shifting lever sticky from a mechanic's greasy hand you have broken down all the confidence he has put into your place up to this time.

He has paid, maybe, several thousands of dollars for his car and he hates to see it abused this way. He cannot be blamed; he is right. It is within the power of every one who operates a maintenance division to provide means whereby the delivery of a car to a customer after it has been worked upon will be attended with cleanliness.

The successful institutions are those which keep a boy busy wiping off the fenders, hood, steering wheel and other parts of the car, immediately after the inspector has pronounced the work satisfactory and the car is ready to be turned over to the customer. No plumber or steamfitter would think of going into a customer's house to do his work and lay his tools on a highly finished piano or keep putting his greasy hands on the pedestal of a floor lamp. Then why have no respect for the motor car which costs many times as much as either of these two articles?

The delivery of the car should be attended by little or no confusion. If a customer has been promised his car will be ready at four o'clock in the afternoon, this should be watched. If it cannot be done at this time, he should be notified by telephone. If it can be done it should be placed so it becomes unnecessary for several attendants to shout around the place and ask, "Hey, where's that car for Jones?"

The way to do is this: When Jones comes for his car inform him that his bill is ready and that he can pay it at the cashier's window. Then let an attendant drive his car to the spot, so that when he is through making payment he

can step into the car. Keep the engine running and if the fuel tank is nearly empty inform him of this fact. It's a little service which costs you nothing but makes a big hit. And, if you can send him away with a word of cheer, so much the better. We know of a service manager who makes it a point so far as possible to see every customer who drives away. He knows them by name and if a certain man is a golf fiend, he makes a few joking remarks about "his game." He has studied the peculiarities of his patrons and knows as he expresses it, "how to get under their hides." "Make 'em feel good" is his motto.

7—Accounting Department

IT HAS only been in the past few years that the subject of accounting has been given much attention when applied to the maintenance department of a dealer's business. It may be due to the fact that in the past there was much so called "free service." Anything was done, just so the customer was satisfied and you got his money for the new car. Future sales brought on by virtue of selling maintenance work was not seriously thought of. Today it is different. Every dealer knows that his future depends largely upon how well he can sell his customer maintenance on the cars they have bought from him.

Every dealer also realizes that maintenance is a real business in itself and must have, therefore, its own various departments, one of the chief ones being the accounting department. Every other line of business has it and the only way in which to find out whether or not you are operating a maintenance business at a profit or a loss is to keep books and records.

The accounting records make possible the plotting of curves to show where the business is going. It tells you which department is making money and which is losing it. It tells you where the leaks are and where overhead is gnawing at the very vitals of the institution.

The larger institutions certainly cannot get along without an accounting department. The smaller business in order to grow must also have some form of keeping books and records in order to plan intelligently for future expansion. There may be only one person in the accounting department, but this person is as necessary as the service manager.

If we are to make use of the flat rate system of selling maintenance records must be kept of all jobs done, operations must be priced and re-priced and many similar things done. All of this means clerical work. Then there is the figuring of the mechanics' time sheets, the costing of parts furnished and the dozen other things which come up daily in the conduct of any business whether it be the performing of maintenance work on automotive vehicles or operating a furniture store.



No business can get along without the heads of it knowing where they stand at all times. Every maintenance department these days must have its accounting department. Unless maintenance is handled on a business-like basis it will not flourish

Why Not Have a Little Research Club of Your Own?

*It's Lots of Fun and There is Also Profit in
Getting the Opinion of Others as to Your
Business*

ANY business man who would be in style this year should be able to discuss at least some of the various forms of research that are going forward in the business world and to tell how they are applying to his own business. Words and activities, you know, have a cycle of styles just as distinctive as women's wear.

This year the style is research, and what a splendid activity it is. It is so in keeping with the women's dress style that it appears to be more than a coincidence. In fact, the more you think about the present dress styles, the more you are led to believe that some research man designed them. But, seriously, getting back to research it is surprising how much that is agreeable and worth knowing a research can reveal. Sometimes, of course, the business that is being researched is like the exceptional woman, it just has to stay out of style.

We were talking about research—business of course—the other evening and one of the party suggested to a merchant friend that he ought to have a

research for his own business, but he said he was only a "little fellow" and could not afford it. Having a kindly feeling for this man so near income tax time, the subject was dropped for the time and we went on discussing buildings, selling methods, his business staff and all of the other things that you can talk over with a man when you know him and then this story was told:

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In the wholesale drygoods field some years ago a Research Club was started by about a dozen non-competitive merchants and so much good resulted that several other lines of trade picked up the idea and have been working on it steadily. In fact there is such a Club in the automotive jobber field, about two dozen jobbers belong to it.

The idea is perfectly simple. The success depends upon how good sports are the men who are invited to become members. Say you line up a dozen good merchants. They map out a dozen meetings, each to be held in a place of business of a member.



In fact, the more you think of the present styles the more you are led to believe that some research man designed them



"When those fellows told me about the cheap cornice and how much it was costing me to operate the freight elevator I got pretty sore"

Meeting day arrives and the men gather at the host's office and he tells them just why he is doing business in this town, more especially why he selected the particular building he is in. He goes on and presents all of the alibis he wants to and the other eleven are bound to listen as long as he talks.

Eventually the host gets tired of talking about himself and concludes to give some one else a chance. Then the chairman of the meeting, it cannot be the host, takes charge and appoints committees—one on buildings, one on inventory, another on volume of business, still another on credits, perhaps one on personnel or anything he and the other members want to suggest, or which are specified in the club papers.

Next these committees get busy and they have the consent of the host to go anywhere on the premises, ask any questions they please and in fact do anything they wish except take the young women employees out to lunch. And usually they have a pretty busy day of it. They are a good deal like a party of children



"They were a good deal like a party of children turned loose in another kid's playroom and they made the most of the opportunity"

turned loose in another kid's playroom and they make the best of the opportunity.

Finally they get tired of this exercise and assemble in the private office and begin to shoot holes in the host's well prepared alibis. The agreement keeps the host silent until the critics get through riddling his business and by that time he is usually speechless with surprise and lets it go at that.

A man whose place of business was given this going over told about it a few weeks later. By that time he had been given the opportunity to even up on some of the other members, cash in on some of the criticisms offered on his business and he was very generally in a pretty good humor about it. Some of his remarks were about as follows:

"I thought I had a pretty good place and especially was I proud of the building I was in, but when these fellows told about the cheap cornice that looked so strange as compared with the copper work next door, and told how much it was costing me to operate the freight elevator and how I was wasting most of the light and a lot of things like that, I got pretty sore.

"Then the inventory committee showed how many ways there were for my clerks

to make mistakes and to cover thefts, how much bigger the cards were than necessary, how my price check would not work and a lot more things, I was simply speechless.

An Eighty Per Cent Criticism

"I plum lost track of the criticisms after awhile and sat there like a dummy thinking over the list of men I knew in town, trying to pick out the fellow that would make the best receiver. But after while these fellows left town and I vowed never to speak to one of them again. But time softens even the most grievous of sorrows and when, a week later, the written criticisms arrived I was able to read them in the same room with the women help and then I filed them carefully but I could not get some of those things out of my mind.

"When the next meeting convened, a month after the invasion of my place, I was present, ready for action but not angry. The first question asked at this meeting was directed at me and the chairman wanted to know how many of the recommendations made at the previous meeting had been put into operation in my store. I answered

'Fifty percent' and that was the truth. The next month I was asked the same question again and I answered '80 per cent and this is final.' Yes, sir, those birds that made me so sore had put over an 80 per cent criticism on my store and I have profited by every suggestion. Also I was host to the best meeting the club ever held, for every member beat it home from my place and tried to make his store bomb proof. But we always had some new ammunition to try on him. One time it was funny, all eleven of us sprung the same idea that we had picked up from a trade paper and then this guy showed us how he had tried to get the thing in operation before we got there but the young woman who had it in charge had been ill and could not finish the job."

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The conversation then drifted back to the previous subject and the "little fellow" who could not afford to take part in any of the research movements began talking about his shop, his building and his own affairs quite critically and also to discuss the other men he knew in the same business and what they would probably think of his business. In about half an hour he had decided on

half a dozen that he was going to invite over to his place some day to eat a bucket lunch in the shop, look things over and tell him frankly what they thought about his place. As the party broke up, the host said to the "little fellow;"

"Perhaps you can, after all, profit by some research."

"Good heavens man," was the quick answer, "I have profited here tonight. I will be working on some of the criticisms made here tonight by 8:30 tomorrow morning. You have all been very kind in offering suggestions, but the biggest thing you have done is to lead me to think and talk about my own business. As I see it now, this evening has been the most profitable one in my life, except the evening when I decided to go into business."

This all sounded very well and before the article was written, a visit to this shop was made to see how the criticism lunch came out; to see if this "Maintenance Shop Research Club" had made good over its bucket lunch, which would take all of these men back to the days when they began their present business careers.

But this club has not yet assembled. No, this enthusiast did not lose his enthusiasm at all. He went to work profiting by his own research the next morning and had been working on the job steadily. In fact, he was so busy chang-

ing and improving things about his shop, getting ready for these critics that he had not had time to issue the invitations.

As a matter of fact, he was just getting his house in order so that he would not be in the embarrassing position of the jobber about whom the story was told, but there had been results and he told us some of his story.

Business had picked up a bit as soon as he cleared out the window and put some bright looking merchandise in the place of the junk and several nearby people had come to inquire about getting work done after he had cleaned up the place generally and had insisted on clean overalls for all hands. He put on another man to hurry up the changes he had in mind, but trade had increased so that even then he was making haste slowly. The girl in the office was inviting her friends to look in on her and some of them made purchases and things were going very nicely.

Sure, he had acted on the suggestion about the overdue bills and not a man had resented his friendly letter calling his attention to the bill. Some had paid, others had come in to explain how hard up they were and one of these had not resented a demand for cash for more work on his car.

Probably there is nothing new or startling in this discourse but, honestly, how many of you have sat down with

some friends that you can trust and conducted a research of your own business. It don't cost anything but sometimes it does a lot of good. This young man did most of the criticizing of his own business because he had an audience to applaud him, and then he had the nerve to act on his own suggestions. It was the fact that he had the nerve to act the next morning that made the evening a success.

Some of these research clubs have paid secretaries who dig up a lot of figures for the club members and a lot of other errands that sound like real research, which after all is only the search for things which have, or should have been known and have been overlooked recently. In most cases research is getting back to earth after a flight in the unknown regions. There was a time when research did not mean anything as simple as this, but it does now.

So, just organize a little research club of your own and profit by its findings. If you cannot do any more, ask your wife to come to the salesroom, or store, and express her most critical opinion of what you are doing. Probably she is very much like (but kinder) than most of your feminine customers and if a store is considered decent by a woman it is likely to please most of the men. They may not know it, but the men will like a clean, quiet place to trade in.

How to Check Up On Stop Signal Operation

SINCE motor car signals are intended primarily for protection and inherently are not absolutely dependable due to lamp failures and switch and wiring difficulties, it is desirable that the motorist know at all times the condition of his signal circuits. Absence of this feature introduces an unwarranted element of risk. Difficulties resulting with numerous methods employing special lamps, resistances, and relays have usually discouraged their use by manufacturers. Special lamps are not popular with motorists because of their high cost and difficulty in obtaining renewals. Even a small resistance in the signal circuit reduces the intensity of the signal lamp very materially. A relay introduces complications in the wiring as well as resistance in the signal circuit.

The indicator features may be positively and inexpensively attained using simple wiring connections, with a two c.p. rear and instrument lamp.

Fig. 1 shows the wiring and switch arrangement for a signal containing one headlight lamp. When the switch is moved from the open-circuit position at A to position B the circuit is closed through the indicator and signal lamps in series. The resistance of the indicator lamp is relatively high in comparison with that of the signal lamp and it therefore receives almost full voltage, whereas the signal lamp remains dark. When the switch arm moves to its extreme position C, full voltage is thrown

directly across the signal lamp. The evidence of proper operation of the signal is therefore a flash of the indicator lamp as the pedal is depressed or a manual switch is closed, and another as it is released. Another arrangement adapted for use with either single or

multiple signals in connection with a single indicator lamp is shown in Fig. 2. The circuits are closed successively in the same manner as is employed in the first diagram; it differs in that any number of signals may be operated singly from the same indicator lamp.

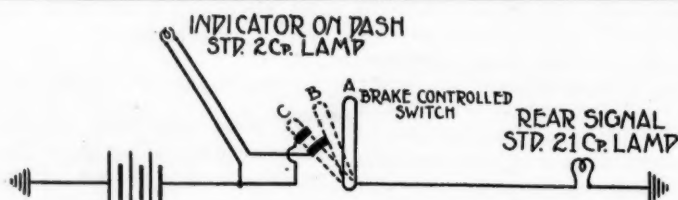


Fig. 1—Wiring diagram of stop signal with indicator lamp

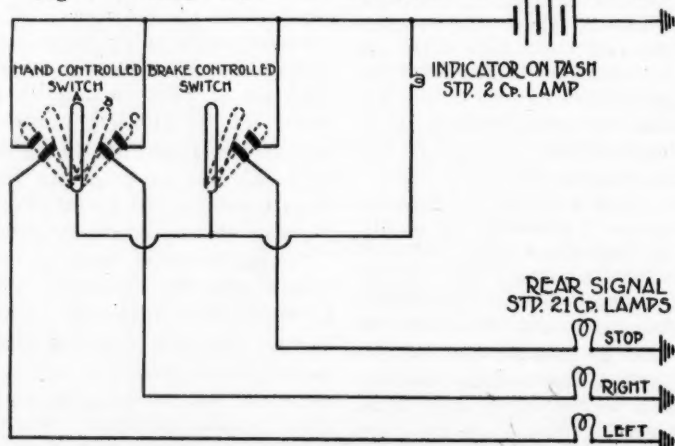


Fig. 2—Wiring diagram of stop and direction signal with indicator lamp

Everybody in the Organization Is a Salesman

INASMUCH as sales concern is everybody's business, sales should be everybody's concern. Therefore, everybody in any organization should regard himself as a salesman, and should be so instructed in his functions that he may be a good and not a rotten salesman.

Take the colored porter in your shop or your showroom. I visited the Seattle branch of the Ford Motor Corp. several years ago. Nobody knew me there. As I approached the door the colored porter, in uniform, was sweeping the floor. He was 20 or 30 feet from the door, but he immediately walked up, opened the door and said, "Good morning. What can I do for you or whom would you like to see?"

Now, I said to Rice, the manager of that Seattle branch, "That porter is the best salesman I have met in a long time." And I wrote a bulletin around that colored porter.

Now, your cashier. I received many receipted bills from cashiers, stamped with a rubber stamp and indicating that they have my money and that's all they care about. I want the fellow to write thank you on that letter. I would discharge a cashier who wouldn't say "Thank you," on a bill.

Your stenographer! What kind of a letter does she write? Probably she uses beautiful embossed letterheads and writes a sloppy letter. She is a rotten salesman.

Reasons for Maintenance

REPAIR man in your shop! There are really only five reasons for service on a mechanical product.

The first is wear and tear, which nobody can prevent. You can delay it by putting better quality in the goods, but finally we all wear out.

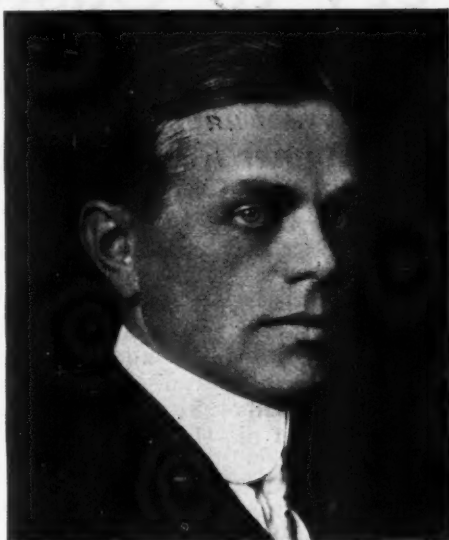
The second is because of faulty design; a poorly designed product.

The third is faulty workmanship or faulty material, or both, in the factory in which its product is made.

The fourth is faulty service on the part of your workmen in repairing jobs.

The fifth is incompetence on the part of the user in not having been told what to do and in not having been told what not to do. I think if half of these buyers were demonstrated with cars after they bought them, and if they were told what to let alone, the cars would be better taken care of.

Your demonstrator, your parts' clerk; every single man in your organization should be taught selling, because even though he is not directly responsible for the sales, the responsible purpose of every single



NORVAL A. HAWKINS

man in your organization, from the ditch digger to the stockholder, is to sell, and the ditch digger loses his sale the minute the Ford factory or your factory or any other factory closes. The man in your employ loses his job when sales stop.

Consider your buildings! What do your buildings look like? Are they attractive? Do they invite me in to look at your product? Are your sales rooms clean? I have gone into sales rooms, with a beautiful automobile sitting on the floor—as beautiful as a Ford can be—when I noticed right across the back of the showroom, a dirty shop, with men on their backs and on their bellies, rolling around, all covered with mud.

That's a damn fine thing for me to look at, in anticipation of buying this beautiful car, with a piano finish, and then look into the next room and anticipating what I am going to look like a week from that time.

Here is a calendar marked "Reed Chains", depicting an accident where some driver skidded into a telegraph pole and killed four members of his family. That's a hell of a thing for me to look at, anticipating riding in this thing that I haven't yet learned to drive and thinking that the first trip I take I am going to kill the whole damn family.

Here is another thing on this side of the wall. It is a calendar also, showing a fine looking ballet dancer. The salesman is trying to sell me a car and I am looking at the girl. He's got a fine chance.

I don't believe a thing should be in a salesroom that detracts from the selling of the automobile that is on the floor; accessories or anything else. Put this stuff in the back of the room. After you sell me a car, tack on all the ginger bread you want. But you brought me in there to buy the car. Don't distract me with a lot of chains and ballet dancers.

Have your house in order so that when I come in I am impressed with the appearance and everything has an atmosphere of beauty, cleanliness and so forth.

Time-Saving Equipment

NOW, your equipment in the shop. We put a machine in the Oakland plant in Detroit and paid \$175 for it. It ground valves in 28 minutes, it used to take a man six hours to do it by hand. We have taken the difference between six hours and 28 minutes off the price that the customer has to pay.

I don't know what kind of tools you have. I know what the Ford has and I know that if that \$350 car had not been the best served car in the world, they would not have sold the first hundred thousand. It would be a fine advertisement to see a million of those cars parked up along the road wouldn't it?

Getting the New Car Ready for Delivery to Customer

***M**ANY Misunderstandings Can Be Avoided If the Proper Steps Are Taken by the Dealer's Organization to Sell the Customer Right at the Start. Inspection Sheets Valuable*

AT THIS time of the year the automotive dealer's business usually "peaks". In other words this is, or should be, his busiest time of the year. This is true of his new car sales and maintenance. Both departments should be going at top speed.

The next question is how to handle these peak loads in order to prevent confusion and building up a lot of

misunderstandings on the part of the new car owner, especially in regards to future maintenance on the car he has bought.

One of the most important things to be done at this time is to properly handle the delivery of the new car to the purchaser. When a man has paid good money for a piece of machinery like the modern motor car,

RUNWELL MOTOR CAR SALES COMPANY (Maintenance Division)

Name of Car.....

Purchaser's Name

Model

Address

Serial No.

Telephone

Engine No.

Occupation

NEW CAR INSPECTION REPORT

- 1—Change oil in engine
- 2—Lubricate clutch throwout bearing
- 3—Lubricate control levers
- 4—Lubricate gear set
- 5—Lubricate front and rear universals
- 6—Lubricate and adjust front wheels
- 7—Lubricate and adjust steering gear
- 8—Lubricate and adjust shackle bolts
- 9—Lubricate differential
- 10—Lubricate rear wheel bearings
- 11—Lubricate brake levers and clevis pins
- 12—Lubricate starting motor
- 13—Lubricate generator
- 14—Lubricate distributor shaft
- 15—Lubricate fan pulley
- 16—Lubricate and adjust valves
- 17—Tighten battery terminals and clamps
- 18—Tighten body bolts
- 19—Tighten running boards
- 20—Tighten spring clips
- 21—Tighten gasoline tank
- 22—Tighten rim bolts

- 23—Tighten windshield anchor bolts
- 24—Tighten instrument board bracket screws
- 25—Tighten instrument board steering column bracket
- 26—Tighten and oil hood fittings
- 27—Tighten and oil fender bolts
- 28—Lubricate and adjust door lock and bumpers
- 29—Adjust brakes
- 30—Inflate tires to correct pressure
- 31—Fit side curtains
- 32—Clean top and car inside
- 33—Fold top boot
- 34—Fill radiator
- 35—Fill gasoline tank (5 gallons)
- 36—Tune engine
- 37—Wash car
- 38—Clean and polish car for delivery

Car Inspected by.....
(Inspector)

Date.....

Here is a suggested form of inspection report which any maintenance department can prepare for use with its preparation of a new car for delivery. When every item has been checked there is every reason to believe that the car is mechanically as perfect as possible.



Before turning a customer loose with a new car, the service manager or an assistant should go over some of the engine and chassis details with him. It will cut down a lot of so-called "free service work"

he feels pretty enthusiastic about the proposition, because he has visions of a beautifully running engine and easy riding car; a car which glistens and gleams in all its splendor of highly polished body panels, nickel-plated radiator and a gallant array of instruments on the dash. He sees only his car and probably imagines it to be the best one that particular company ever built.

The Pride in a New Car

The new owner, we say, is enthused. It is right that he should be. He has looked forward to this new car. Perhaps he has driven many other cars, but there is always present a certain zest when you buy a new car and drive it for the first few times.

Now the point is to keep this owner feeling that way about his new car and the first thing to consider, after he has agreed to buy the car, is to make sure it will be entirely ready for him when the date of delivery comes.

Much of the good will which a dealer may have built up in a customer will be undone at the time of delivery of a new car to that customer, unless certain very essential things have been attended to.

We realize that most maintenance departments are very busy at this time of the year and it is generally the maintenance department which must get the new car ready for delivery to the new owner. Consequently there is always present the danger, owing to the rush of business, to slight something in the way of preparing the new car.

New Cars Need Inspection

Every dealer knows that cars which come through from the factory are not perfect in every way. Where large production is the rule, it is even more so. We have had dealers tell us that they have spent as much as \$30 per car on a new car to condition it for delivery. This figure naturally will vary with the make of car, but the above figure was given to us on a car selling in the \$1700 class.

There is many a slip between the factory and the customer whether the cars come by freight or driveaway, the latter, by

the way, being a rare procedure these days when freight cars are plentiful. It is all right to trust to the factory to a degree, but it is far better to take no one's word for anything. A rigid inspection in the dealer's maintenance department is the only way to make sure that nothing has been left undone on the new car. In fact, in many cases, there is an understanding between the factory and the distributor or dealer as to certain things which can better be handled when the car reaches its destination.

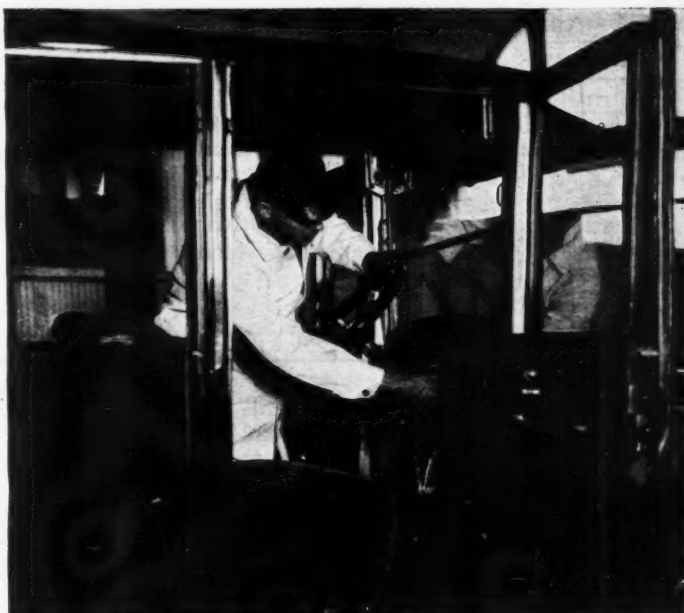
Then there is always the customer who wants something a little different. He wants drum type of headlights, a stop light and a few other things, and he usually wants these when the car is delivered to him. He must be cared for along with the customer who is less particular.

There is just one way in which to make sure that the new car which is to be turned over to the customer, is ready in every detail—work to a definite plan, involving the use of an inspection report. This report must cover not only the car itself, but the equipment. No customer likes to drive away a new car, to find that the battery in it is not perfect, or that there is no jack in the kit of tools.

Correcting Troubles While Small

When all is said and done a new car when delivered to its purchaser should be as nearly perfect in every respect as human ingenuity can make it. It will pay every dealer to keep one or two men busy just on the inspection and conditioning of new cars. This does not mean only a superficial cleaning of the car, filling the radiator, adjusting the carburetor, etc., but, dozens of other things. Bolts and nuts are not always set up any too tightly at the factory and it is a bad mistake to think that just because a car is new that all parts are set up tight. Again we say, take no one's word for anything. There may be a grease cup for greasing the clutch release bearing, but you cannot be sure that the bearing is greased unless you remove the cup, fill it and screw it down.

We have watched the inspection of some new cars and frankly can state that many dealers have as yet a lot to learn about this end of the business. They do not work to a definite plan. The men doing the inspection have no forms from which to work and check and the result is that their efforts are not logically applied. They will fill the radiator and then suddenly give the grease cups on the front springs a few turns. Then they may take a rag and polish the windshield. While in the vicinity of the windshield they spot the lighting switch



The last thing that should be done to the car before turning it over to the customer is to have an attendant clean it thoroughly. And by all means let the man wear a clean duster when he does the work

RUNWELL MOTOR CAR SALES COMPANY

(Maintenance Division)

Name of Car	Purchaser's Name
Model	Address
Serial Number	Telephone Number
Engine Number	Occupation

NEW CAR EQUIPMENT CARD

(Each of the following items must be included in the equipment of this car)

1—Starting crank	8—License clamp	15—Tool bag, containing fol-
2—Tire pump	9—Windshield weather strip	lowing:
3—Rim wrench	10—Top boot	1—Screwdriver
4—Rim spreader	11—Curtain irons	2—Monkey wrench
5—Jack and handle	12—Inside curtains	3—Spark plug wrench
6—Oil can	13—Extra rim or wheel	4—Set of end wrenches
7—Instruction book	14—Two switch keys	5—Hub cap wrench
		6—Pliers
		7—Punch
		8—Magneto wrench
		9—Hammer
		10—Chisel

Date..... Equipment Checked By.....
(Inspector)

No customer will complain that his car is minus this or that if an equipment card like this one is used and properly checked

ADDITIONAL EQUIPMENT WHICH HAS BEEN ORDERED BY CUSTOMER

*Note: This equipment is not to be installed unless customer's signature is affixed below.
Only the items checked are to be installed.*

1—Anti-glare lenses	5—Gearset lock	9—Hood and radiator cover
2—Snubbers	6—Motometer	10—Initials on door panel
3—Bumper	7—Extra tire	11—Parking lamp
4—Spotlight	8—Windshield cleaner	12—Fire extinguisher

The Equipment Checked on This Card Has Been Ordered by Me

Date

Purchaser's Signature.....

Additional Equipment Checked by.....
(Inspector)

On the reverse side of the card above might be listed additional equipment which the customer has ordered installed. This card should be signed by the customer after the items he wants have been checked. This card as well as the inspection card on the previous pages should be filed in the office

and try it to see if all lights burn. You will see from this that the man does not work logically. He should check all the grease cups at one time, do all the work on the electric system at one time and the car should be given a wash and polish at one time.

Checking Several Cars at Once

If two or three cars are to be conditioned for delivery it is possible for one man to work logically on all three. For instance he can have the inspection sheets for all three cars

placed on a desk and perform the same operation consecutively on the three cars. Thus, if he has inspected, let us say, the battery on No. 1 car, he checks it off on the inspection sheet for that car, then proceeds to the battery on No. 2 and No. 3 car.

Our course, during the peak load of business the service manager probably will put more than one man on the job of getting new cars ready for delivery, because generally the new buyers all want their cars about the same time and the same hour of the day. But it is possible to conserve man-



The proper equipment will help greatly in getting new cars ready for delivery. A high pressure grease gun will insure quick chassis lubrication, especially if the car is on a runway

power on the inspection of new cars by having one man work logically on a number of cars.

Many well conducted maintenance divisions today are employing systems of inspections for getting the new cars ready which hardly can be improved upon. The forms used are such that when the inspector puts his name on the sheet, he knows that that car can be turned over to its purchaser without the slightest hesitation on the part of the organization.

A History of the Car

A new car inspection report should be gotten out by every dealer's maintenance department. It can be made up to cover the particular car he handles, because, obviously, conditions will not be the same with every make and model of car. A lubrication chart usually is available from the factory and this will help to locate all the points that must be oiled or greased, tell what kind of lubricant to use and give the amount also.

The inspection sheet should be made out so that it contains the name and model of car, engine number, serial number, name of purchaser, etc. Then, when filled out it should be attached with the "history" card which many dealers now use to keep a record of a car from the time it was purchased and filed. Later on, if any question arises about the car the inspection report can be brought to hand and very often it will settle a question then and there. An owner might state that the rear wheel bearings never had been lubricated but when the inspection report is produced, with the item properly checked off by the inspector and his name attached to the report it is pretty good evidence that the work had been done.

A special form should be provided for the equipment that goes with a car. It means that every item will be checked off as it is found among the tool equipment. The missing items are noted and supplied. It may be just a small magneto wrench that is missing, but just as sure as fate if it is not supplied the customer will get stranded on the road some day, read about adjusting the magneto points in his instruction book and then when he finds no wrench there, he gets mad and curses the dealer's organization for either having failed to provide him with one or taken it from his equipment.

If the inspection shows a certain item missing and it cannot be supplied immediately, the customer must be told of the facts. He will then understand and feels all right about the case.

A Check on Equipment

The back of the equipment inspection report might contain a list of accessories which are common and which the purchaser of the car has ordered installed. This list must be checked by the inspector to see that all work ordered has been done and that it has been done correctly. If a spot light has been added, it does not suffice to merely see that it is there. It must be tried several times to see that the switch works



A trim department is handy not only for regular maintenance on cars, but in going over the curtains, upholstery, etc., of a new car, should it need a few minor repairs or fittings

properly and that the light can be swung into any desired position. The inspector really must play the part of the customer. If an installation does not suit him the chances are ten to one it will not suit the customer. The inspector must decide the merits of a job.

It should be understood, of course, that the inspector does not necessarily have to do the actual work on the new cars. He may do the supervision of the work. Thus, when the car is ready for the final wash and polish, it is taken from the new car department and sent to the wash rack. However, when it is ready for the customer the inspector checks the final wash and polish. In the same way a boy might fill the radiators, fold the top boot properly, fill all grease cups, etc., but his work must be checked by the inspector. The inspector alone should be responsible for the condition of the new cars at the time they are turned over to the purchasers.

A Road Test Before Final O. K.

When the car has been given its mechanical inspection, equipment checked, etc., it might well be taken out by the road tester to ascertain if all adjustments have been properly carried out. The brakes can be tested, etc. After all this has been done the car can be turned over for the final cleaning and polishing, whereupon all the inspection reports and road tester's cards will have been properly signed.

ADVANCES IN ACETYLENE WELDING

Recent advances in acetylene welding and some of the problems confronting the welding industry are considered in a report of the Oxy-Acetylene Welding Committee of the International Acetylene Association. It is stated that metals of almost any desired composition can be deposited by the oxy-acetylene torch, but that many important problems like preheating, heat treatment and annealing require consideration. Duriron, a high silicon cast iron, is being successfully welded, but must be most carefully preheated. Manganese steel is difficult to work, but good results are being obtained on simple castings. All of the regular alloy steels, such as nickel chromium and vanadium, can be welded without difficulty, but inasmuch as the welds are usually wanted where great strength is required, the process does not hold out much promise, unless the metal can be poured and heat-treated. Monel metal, which is being used for valves and similar purposes, has been welded successfully, and further studies are being made in this direction.

AN AID TO STARTING

Fiat cars are now being fitted with a patented solenoid-operated valve which acts as a strangler, closing automatically when the electric starting motor switch is closed, and opening again when the foot is removed from the starter switch. The object, of course, to insure a rich mixture for starting without depending upon hand operation.

Aircraft Maintenance as a Standard for Motor Car Maintenance

THE Importance of Accuracy of Tolerances and Rigid Inspection if 100% Performance Is to be Secured. The Serious Consequences of Trivial Omissions. The Function of the Log Book, the Tolerance Sheet and the Timing Disk. The Mutual Dependence Between Pilot and Mechanic

By P. L. DUMAS

THE servicing of airplane equipment is fundamentally similar to rendering service to automobiles. The outstanding differences can be grouped under several heads and sub-heads. Before any idea of the items that are dissimilar can be accurately formed, it is necessary to first consider the daily duty of the automobile as compared to duties demanded from the heavier-than-air ship.

The motor vehicle engaged in the transportation of merchandise is called upon to operate for long periods without undue attention while the period of daily operation of the airplane is of usually much shorter duration. This does not mean that the power plant of the airplane is not subjected to as great a strain as the motor truck power plant. In fact the engine in the airplane during its average four hours of daily operation is called on to do what the engine of the motor truck would not do in a month of average usage. The same holds true of the entire structure of the airplane.

The redeeming feature of the airplane is its ability to provide speedy transportation. But the value of the speed is destroyed if the reliability is sacrificed. The cost per mile at the present time is considerably greater than the cost per mile of transportation by means of the motor vehicle. It is for these reasons that the cargo carried by this method of transportation is in every case something of greater value than usually carried by the motor vehicle.

The Costly Result of Carelessness

The damage done to a motor vehicle or to an organization operating vehicles from a breakdown on the road is of very minor importance, comparatively. A breakdown or forced landing of an airplane may entail inestimable damage. The airplane itself may be damaged greatly and there is the possibility that the operator or pilot may receive serious or fatal injuries. The seriousness of a forced landing is much greater in the case of the airplane; first, because the forced landing takes the airplane out of its element, which is the air, and places it at the mercy of gravity. The sudden stopping of an engine when the vehicle of the road is on a steep grade is not half as embarrassing as the "konking" of an airplane engine when the plane is at a low altitude and directly over a large and densely settled city or over the sheer peaks and irregular surface of a mountain range.

The airplane engine to maintain the ship in the air must revolve constantly at a speed within twenty-five per cent of its maximum revolutions. It must maintain this speed with absolute smoothness because vibration would rapidly disintegrate both the engine and structure. The structure of the plane or ship will require considerably more care than the motor vehicle chassis. The omission of one cotter pin is sufficient to upset the proper functioning of the ship as a whole with a consequent forced landing as the most optimistic result.

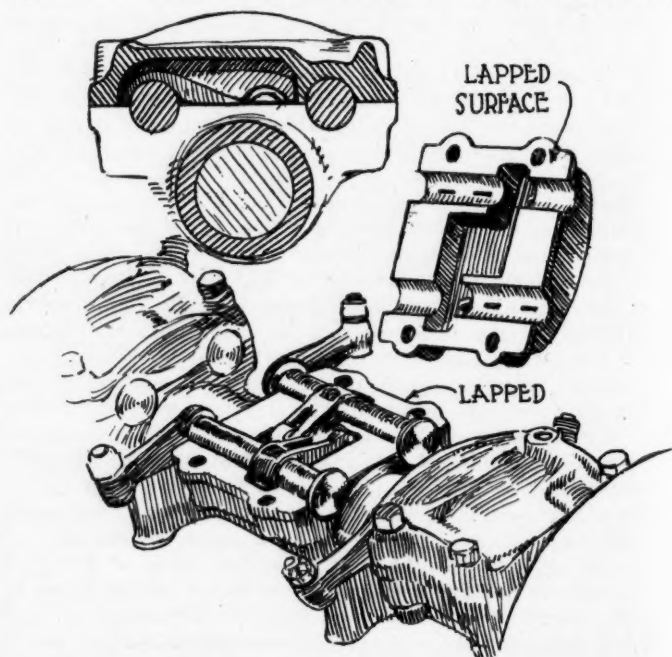
(While naturally the omission of a cotter pin may result in disaster to an airplane much more readily than in the case of a motor car, there is every good reason why much the same

care should be taken to see that every nut is fitted with a lock washer or secured to the bolt by a cotter pin in the case of the motor car or truck. Too often we find loose nuts and bolts on the chassis, which ultimately may mean many dollars spent by the owner for repairs which could have been avoided.)

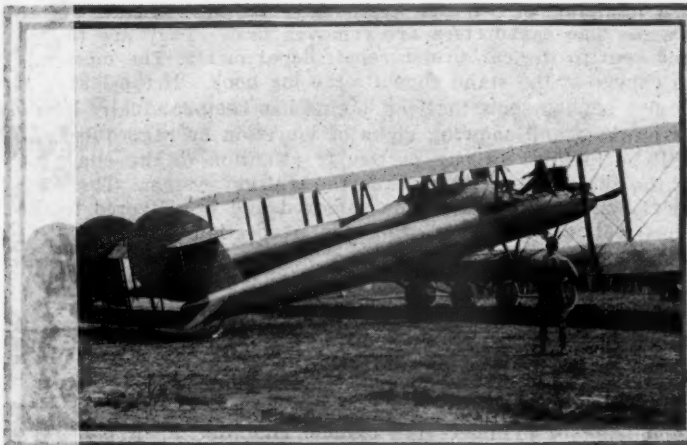
Just the proper alignment of the wings and control surfaces must exist or the flying of the ship will be erratic. An erratic flying ship means that the craft may handle alright under one set of conditions, but will be difficult to control under another set of conditions. For instance, the ship may be very stable with full power on, but may show a marked tendency toward tail heaviness with partial or no power applied.

The Importance of Inspection

Having seen a few of the points of difference between the vehicle of the air and the vehicle of the earth, it is not difficult to readily see the great importance of what is called inspection. The vitalness of inspection cannot be too heavily emphasized. The finest of workmanship and the most elaborate of



A portion of the camshaft assembly of the Liberty aircraft engine. Rocker lever has its bearing in the housing and housing cover, and rides directly on the aluminum alloy. To maintain the proper clearances at the bearings and to retain the oil, the housing covers are lapped to the housing after the bearing has been fitted. The tappet clearance is maintained by the addition or removal of steel washers from under the tappet bolt, which in this engine is not threaded into the rocker lever arm. The condition of the rocker lever rollers and pins must be perfect in order to accurately time the valves and to avoid "roughness" of operation.



A multi-engine airplane before and after what is considered a "slight crash." In this case the damage was comparatively slight as far as crashes go, but the loss in dollars and cents would run up into the thousands. The lower photo depicts what is known as a "complete washout." The omission of a single cotter pin or lock wire can mean either a slight crash or a complete washout. Practically no salvage is possible from the debris in the complete washout, the application of the match to the wreckage is the last act, after which the ship is marked off the books. Under very favorable conditions the ship which is shown as slightly crashed may be repaired and fit for service again in a month's time. Constant daily systematized inspection is the greatest preventive of such occurrences. The true extent of the damage is not fully appreciated at first glance, but the force of the impact with the ground is usually sufficient to permanently disarrange the entire ship structure, which means that the entire ship must be disassembled and rebuilt. Constant daily and systematized inspection is one of the preventives of such occurrences.

equipment are as nothing if there is no inspection. Inspection of aviation spells the difference between life and death.

(The matter of inspection is one of the most important in connection with automotive service work. A mechanic may do ever so good a job of fitting new differential gears, but suppose he forgets to wire the adjusting screws and the housing cover is replaced and the car sent out. A rigid inspection system will catch the omission. It is worth it on a piece of machinery like the modern automobile.)

The human element enters into the servicing of the aircraft to a more marked degree than perhaps any other line of kindred endeavor. The very highest grade of workmanship and the most complete and accurate inspection is secured only by creating the proper mental attitude. It does not require an accurate or extensive knowledge of psychology but consists mainly in realizing constantly the individual responsibility. It is, in short, morale.

Morale and Maintenance

The maintenance of morale is brought about by several methods too lengthy of discussion. Cheerful surroundings, good equipment, skillful supervision, and well cherished incentives play a large part in securing and holding the right sort of personnel. Much in addition could be said about the airplane structure which presents in itself an assembly that requires fully as much attention as the powerplant.

Good aviation engines will deliver from 80 to 175 hours of service before an overhaul is necessary. Careful account of the history of each engine is kept by means of the log book which is a part of the regular equipment of each engine.

The air mail service of the post office department has done more organized cross country flying than any organization in the United States. The hard school of experience has taught many problems concerning cross country flying during the winter months that previously were unknown. The continuous operation of a 400-hp. high efficiency engine at temperatures ranging from forty above zero to forty-five below presents some perplexing conditions. The wide range of temperature variation referred to is often experienced during a single four-hour flight.

Such conditions demand that particular attention be directed to the accuracy of the instruments such as the oil pressure gage, the tachometer, the altimeter and the engine thermometer. The tachometer provides for the pilot all the information and more that the speedometer supplies to the motorist. Besides being invaluable to the operator of the airplane, the tachometer is absolutely essential to the service man in that it provides an accurate check on the performance of the engine without the necessity of a test flight.



(Something might be said here regarding the use of tachometers on automobile engines. To a service man the tachometer would mean much. It would make it possible for him to make all the adjustments for carburetion, ignition, valves, generator charging, etc., without having to take the car out for a road test. It also would make it easier for the owner to shift gears, because he could gauge his shifts more accurately by watching the tachometer showing the revolutions of the engine.)

In conjunction with accurate instruments it is important that the methods of controlling the temperature of the engine be such that they are both absolutely reliable and light in weight. The propeller, which acts not only as the means of locomotion but also as the flywheel of the engine, is also worthy of mention. It is at first difficult to realize that a piece of wood 9½ ft. long and less than a foot wide will absorb 400 hp. An out of balance condition or a variation in the weights of the two blades of the propeller can affect the balance of an engine to a marked degree. A variation of much less than half an ounce in the weight of either blade at the tip will cause a vibration in the engine so severe that it would be unsafe to operate.

Maintenance of Air Mail Equipment

There are perhaps many hundreds of men in the automobile maintenance business who served during the late war in some capacity in the air service. To these men the things

that have been said here are of no particular interest. To these readers who were either fortunate or unfortunate enough not to have undergone the experience these few facts may be interesting.

Most of us are familiar with the system of automobile powerplant maintenance as practiced by the up-to-date organizations engaged in such work. The organization of the air mail service consists of the operations and maintenance departments at each large depot or airdrome. The two departments in action function as follows: The mail to be carried is transported to the airdrome by motor truck. On its arrival at the airdrome it is checked by a member of the operating crew then on duty. The number of pouches and the weight are noted and the pilot is given a duplicate slip showing the exact amount of his cargo.

Testing Before Flight

Previous to the arrival of the mail the ship had been gassed and oiled and the amount of each was recorded in the log book. After the gas and oil tanks have been filled the ship is wheeled out to the "deadline" or testing ground. The wheels are blocked and the engine is started. After idling for at least ten minutes the engine is given wide open throttle for an instant. During this instant the tachometer reading and the oil pressure and temperature ammeter readings are carefully noted. If this data compares favorably with the entries in the log book of the day previous the engine is considered safe to fly.

The revolutions, temperature and pressure readings are then recorded in the log book which remains with the engine continuously. Meanwhile the rigging inspectors have carefully gone over the rest of the airplane and if everything is in perfect shape the entire ship is pronounced O. K. Upon arrival at its destination the total time consumed during the flight is recorded in the log book. The amount of gas and oil required to fill the tanks gives the amount consumed during the flight and this is also recorded.

The instrument readings at the end of the flight are recorded. The entries for each day are made in their respective columns in the book. One column is devoted to the readings at start of flight and the other column to the instrument readings at completion of the same flight. The hour of starting and the hour of the finish are entered, as well as any other pertinent information such as an emergency landing due to mechanical trouble. If any parts of ship or engine are replaced they are also recorded. This diary of information is of great value in diagnosing trouble. It affords a complete life history of the engine which is invaluable to the maintenance department.

When the engine shows signs of weakening, which is first denoted by a falling off in revolutions, it is condemned and is removed.

(This is not true generally speaking of the engines in motor cars or trucks. The drivers behind these fuss with everything from the gas mixture to the rear axle gear ratio to get more power, which the engine is losing probably from a very legitimate cause. If a competent service man could get on the job when the engine first shows signs of losing power, a lot of unnecessary service work could be avoided later on. An airplane is not permitted to fly if the engine shows any signs of faltering, but an automobile, because its four wheels rest on the ground, may be abused miserably by an unsuspecting owner who often cannot tell when one or more cylinders may be cutting out.)

A tag is attached to the engine which states the reason for removal which may be one or more of several, such as loose bearings, leaking valves or crooked cylinders. The log book is also attached to the engine. Each engine has its own log book.

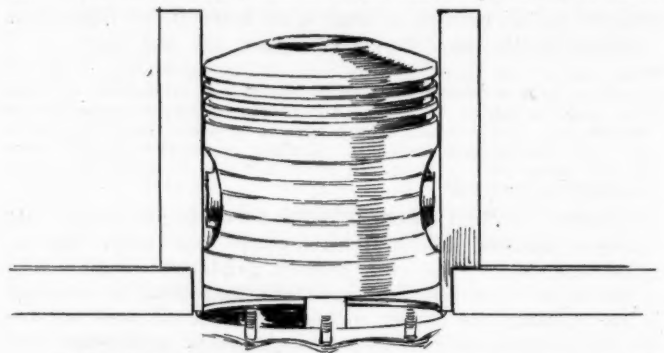
The maintenance or engine repair shop receives the engine. It is placed on a repair stand and securely bolted in place. After a thorough external cleaning it is ready to be disassembled.

No airplane engine is ever disassembled without being placed in a motor stand, nor is it disassembled before being thoroughly cleaned. This state of affairs might well be copied in many automobile service stations. It is possible to do a much quicker and better job of dismantling an engine when it is clean. Besides, it builds a higher morale in the shop and the men have a much more intense desire to do good work. All of which pleases the customer and incidentally makes for a better business for the dealer.)

A minimum of two men are usually assigned to each engine stand. The carbureters are removed first. They are tagged and sent to the carburetor repair department. The mechanic in charge of the stand consults the log book. If the last four or five entries show that the engine has been gradually losing revolutions and showing signs of vibration or raggedness, he will be inclined to pay particular attention to the condition of the valves, the cylinders and the ignition system. The complete ignition system is then removed and is delivered to the electrical repair department for inspection and repair if necessary.

The next operation is to check the backlash of the camshaft driving gears. The backlash is checked with a thickness gage and if it is out of range of the recommended practice which is noted on the tolerance sheet it is mentally noted for future reference. The overhead camshaft assembly is then removed as a unit. After the removal of the camshaft assembly from each bank of cylinders the cylinder holding down bolts are loosened. The cylinders are then removed and with the camshaft assemblies they are placed on or sometimes under the bench. The various other parts are then removed and laid on the bench. These parts are the pistons, the piston pins and the connecting rods.

The crankcase is then very thoroughly cleaned on the inside and is examined for possible cracks or warpage. After cleaning the crankcase the thrust bearing on the crankshaft is examined. The thrust bearing is of vital importance to the proper performance of the engine. It relieves the main bearings of the end thrust which on some engines runs up to fifteen



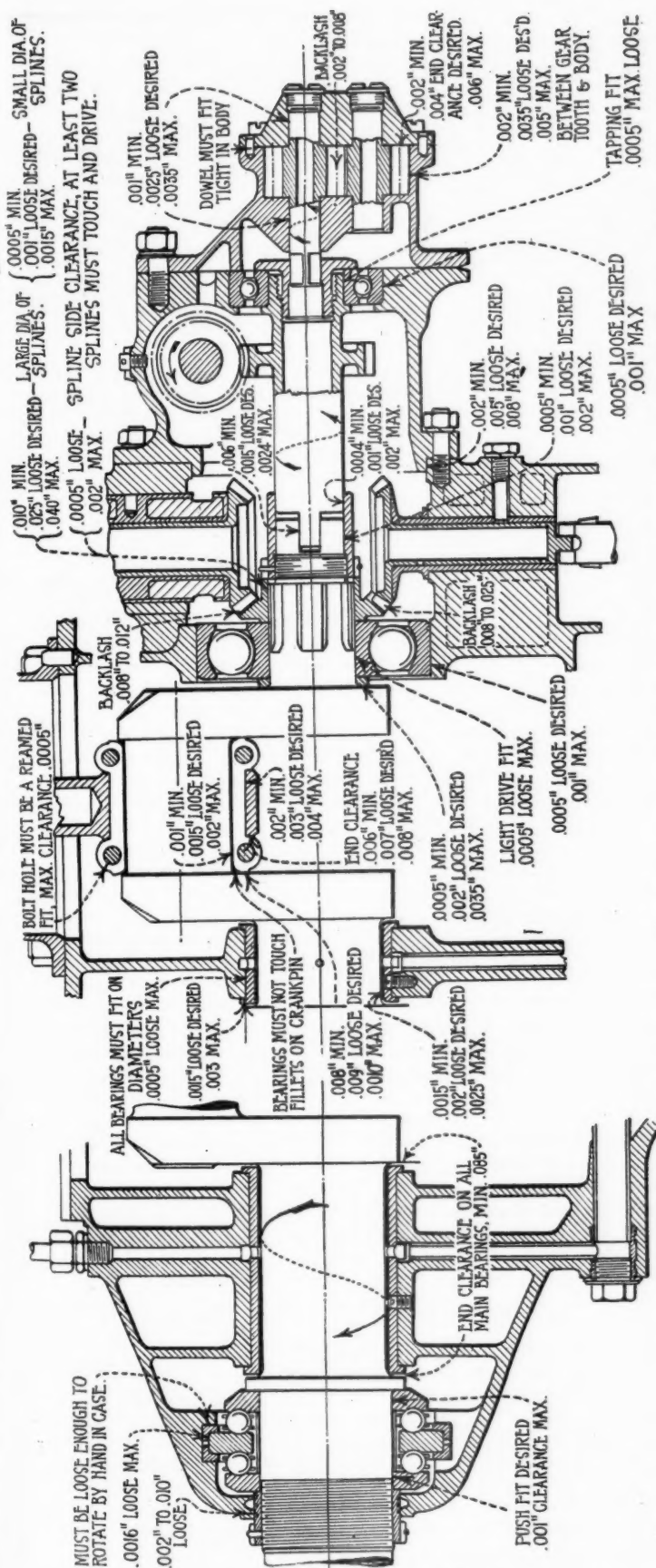
Final alignment checking of piston and connecting rod assembly which is done just previous to installing cylinders. This particular piston installation has a ring land relief of .030, which explains the open spaces between the two try squares and the piston at the ring lands. The great amount of clearance shown on the piston outside wall at the piston pin is to relieve the piston at that point from any tendency to score the cylinder. The piston pin is retained by a banjo-shaped aluminum button.

hundred pounds. The action of the propeller tends to pull the crankshaft out of the engine and this is prevented only by the thrust bearing, which must be of ample size to successfully handle the high thrust loads. The crankshaft is then removed and the halves of the crankcase are bolted together.

Bearings Non-Adjustable for Wear

In most aviation engines the lower half of the main bearings is carried in the lower half of the crankcase. The connecting rods, if the engine is of the V type, are in most cases of the yoke type and both main and connecting rod bearings are non-adjustable for wear. The main bearing mandrel is then inserted through the bearings in place of the crankshaft. The degree of looseness of its fit in the bearings determines whether or not the bearings require replacement. The clearance is measured by narrow strips of sheet metal of known thickness. Each bearing is thus gaged and if consultation with the tolerance sheet shows that the clearance is greater than the maximum allowable, clearance bearings will be installed.

Bearings are line reamed for the preliminary fit and are then finished scraped. After the scraping has produced a 90 per cent bearing surface and the proper clearance has been secured, the babbitt is hand burnished. All bearings of the babbitt faced type are fitted on mandrels. The mandrels are



The maximum, minimum and desirable clearances are shown for each bearing shaft and gear. This is only a portion of the full drawing which covers the tolerances to be allowed between moving parts. This sheet pertains to the Hispano-Suiza engine. Tolerance data is also sometimes printed in the form of a table or chart without including the blue print illustrations such as here shown. The close limits to which the connecting rod bolt hole is held is typical of the class of workmanship which is necessary in an aircraft engine.

made in different degrees of oversize. Before any fitting is undertaken the crankshaft is placed in a lathe to determine if it is or is not slightly sprung. The main and connecting rod journals are micrometered and if any out of round condition exists the shaft is reground.

(This testing of the crankshaft is worthy of thought. In many of our automobile service establishments they are not even properly equipped to check up a crankshaft, to say nothing about truing it. Too often a man will attempt to put in a new set of bearings and not even make any attempt to ascertain the condition of the shaft. A sprung shaft cannot be detected by looking at it and while the engine is down is the time to inspect all such parts as crankshaft, pistons, cylinders, camshaft, tappets, etc. As long as a man has taken an engine apart for some reason, he should take advantage of the opportunity to inspect the essential units.)

If an excessive variation is shown the shaft is discarded. Particular attention is directed to the tapered end of the shaft which carries the propeller. Some time in the history of the airplane in which the engine was installed it may have nosed up on the propeller, that is a poor landing on rough ground caused the ship to start a forward somersault, stopping only after it was completely on its back or coming to rest with the tail vertical in the air and the nose resting on the propeller.

Where Patience and Skill Are Required

If the crankshaft shows no wear, the bearings are fitted tight on a mandrel of .002 oversize for the main bearings and to a mandrel .004 oversize for the inter-connecting rod bearing. The inner and crankshaft bearings having been fitted, the next step is to fit the outer or blade rod bearing. This fitting operation requires unusual patience and skill. This bearing has its journal on the bronze back of the inner connecting rod bushing.

The adjustment of the inner bearing may have caused the bushing to assume a slightly elliptical form on the outside. The outside of the inner bushing must be truly circular before the fitting of the outside or blade rod is attempted. The amount of clearance allowed here is approximately .006. The amount of end clearance of the bearings is carefully gaged and is not allowed to vary from certain set limits which are designated on the tolerance sheet.

(No doubt, the future will see more and more of this tolerance sheet idea applied to automobile service stations. As it is now, one mechanic thinks the pistons ought to have so many thousandths inches clearance while his benchmate thinks it ought to be a few more or less. The factory may have its own idea also. But with a tolerance sheet gotten out by the maker and hung on the wall uniform results can be expected. A sheet showing the clearances of pistons, bearings, end play, gear teeth fits, valve clearances, etc., furnished by the engine maker would be highly desirable in every service station.)

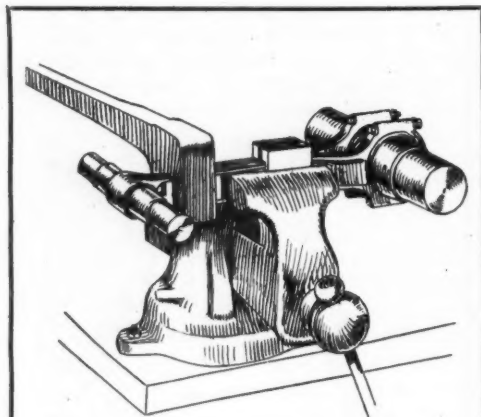
Two skilled mechanics will require on an average of six days to complete the fitting of the main and connecting rod bearings. The connecting rods are tested for straightness and if they check are fastened to the crankshaft. The fitting of the bearings having been completed, the crankshaft with or without the connecting rods fastened to it is placed in the crankcase. The case is bolted together and all locking devices are set. The connecting rod alignment is again checked with the rods installed, on the crankshaft. If everything checks O. K., the bearing fitting has been completed. The crankcase assembly is then covered with a tarpaulin.

Each Operation Must Be Completed

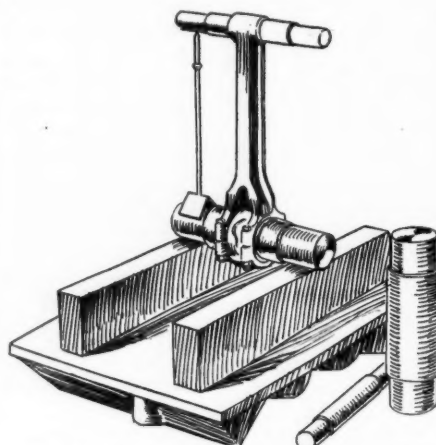
One of the fundamentals of the system is to fully complete each operation on each unit before starting work on another unit. This means that the crankcase assembly will not be touched for several days so a cover is placed on it to prevent the entry of dust and eliminate any foreign particles from being accidentally dropped into the case.

(Contrast this covering up of the crankcase assembly with what one ordinarily sees around the average service station shop. No such precautions are taken. Engine parts are scattered around the floor or bench along with tools, puddles of oil, grease and dirt. Certainly this protection of the work in the shop is something which most service shops can afford to take to heart seriously.)

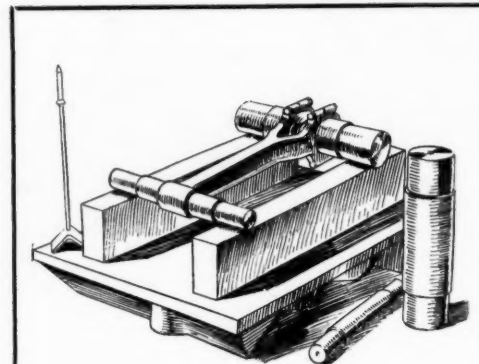
Each overhauling crew is furnished with a special assembly bench which is portable. It is especially constructed for the particular engine being serviced and is so designed that all of the parts of that engine are conveniently accommodated.



Straightening a bent connecting rod. Brass or steel blocks are fitted in the web of the connecting rod to prevent the bending bar from injuring flange of the connecting rod.



In this view the rod is being tested for straightness. The dummy piston pin and the dummy crankshaft must be exactly parallel. A surface gage mounted on a vee block is used to check the distances on each side of the rod. This test will determine whether the rod is bent but will not detect a twisted rod.



Using the same dummy pin and crankshaft, the rod is placed in this position to detect a possible twisted condition. If the rod is not twisted, the dummy piston pin will touch both base irons without any visible air gap.

One of the men begins work on the pistons and the other starts the overhaul of the camshaft assemblies.

(Engine stands rapidly are becoming more and more in use in the service stations. One of the popular six cylinder engines requires about 8 to 10 hrs. to tear down and rebuild, with two men working on it and with the engine not supported in a stand. With a stand, two men can tear down and rebuild the same engine in 1 hr. and 50 min., using, of course, special speed wrenches, spanners, etc. It goes to show the value of good equipment.)

The rings are removed from each piston and are tagged. The carbon accumulation is removed from both inside and outside. The bare piston is then checked against the tolerance sheet on all dimensions. If it is found fit for further service, it is cleaned with a power driven brush and given a polished surface on the buffing wheel. The piston pins, which in most cases ride directly in the piston bosses, are then examined and checked for fit in the connecting rod small end bushing. The pistons having been checked, they are placed on the special type assembly bench.

Cylinder Bore Micrometered

The same man who overhauls the piston units will always also overhaul the cylinder assemblies.

As in the case of the pistons, the carbon is first removed. The cylinder bore is micrometered and with its particular piston is checked against the tolerance sheet. The cylinder is then tested under pressure to show up any porosity or slight cracks that, strange to say, are not unusual in a light-weight steel cylinder. Providing the test is passed satisfactorily, the valves are taken out, examined and refaced.

The valve springs are each given a test to determine their deflection under a certain load. This is done by placing the valve spring vertically on the platform of a weighing scale. A cross bar is placed across the end of the spring. Two studs in the bench guide the cross bar which has a hole at each end through which the studs pass. The pressure exerted by tightening the nut on each stud is transferred to the dial of the scale. The valves are ground to a narrow seat and are tested which completes this operation.

(Ordinarily the valve springs in an automobile engine look pretty much the same to the average mechanic, but several of them may be weaker than the rest and therefore the valves to which they are fitted will not seat as rapidly as the others. Exhaust valve springs, especially, get very hot and in time may lose considerable of their stiffness. A testing device like that mentioned in the preceding paragraph certainly would work out to advantage in automobile engine work. It is done in some service stations, but not quite so elaborately.)

The overhaul of a camshaft assembly requires more time than would be first imagined. Each assembly consists of twelve rocker arms with their rollers and pins and twelve rocker arm bearings. This is, of course, for a twelve-cylinder V engine. The rocker arms have their bearings in the aluminum camshaft housing and housing covers. The main-

tenance of just the proper amount of clearance is necessary because if the bearings are fitted just a little too tight they will seize and stick when the aluminum housing expands due to the heat of normal operation. If they are slightly too loose they will leak oil badly.

Excessive clearance is taken up in one leading type of engine by facing the camshaft housing covers which act as the upper half of the bearing. Gaskets are used in only a few places in the average aviation engine and these covers are lapped to a fit to the camshaft housing to prevent the leakage of oil. This lapping process requires time and patience and when the six covers of each camshaft assembly have been fitted and lapped, the greater part of two days has been consumed. The conditions of the surface of each cam is carefully examined and any rough spots are smoothed off with an oil stone and crocus cloth.

The camshaft bearings are non-adjustable and if they are worn beyond the recommended limits they are replaced with new bearings. A check of the cam contour and timing angle is usually not made until the assembly has been placed on the engine. This procedure is followed because a jig to check the cam lift, contour and angle would be both expensive and complicated.

The water pump and various driving shaft assemblies are then put through the same system of inspection and overhaul. As the lubrication system is always of the full pressure type, compressed air is used to blow out any dirt or dust that might have accumulated in the many oil passages in crankshaft and driving shafts. All of the units having been serviced, they are placed in their proper position on the assembly bench.

Balancing and Weighing Parts

If any reciprocating part has been replaced, it has been weighted and balanced. A variation of half an ounce is allowed on pistons, but the connecting rod weights are held to close limits. If the log book gives a history of chronic roughness or vibration in the engine, all reciprocating and revolving parts are checked as to balance regardless of their condition. The roughness of operation, if it is not due to unbalance of parts, is most likely caused from a lack of synchronization of the ignition interrupter mechanism, or a variation in the valve timing of some of the cylinders.

A twelve-cylinder V engine with the cylinders set at 45 deg. fires at unequal intervals. There are two power impulses every 120 deg. of crankshaft travel but they do not occur at 60 deg. intervals. One impulse or explosion occurs at 45 deg. and the second follows 75 deg. later. This necessitates an interrupter cam that will have wide lobes and narrow lobes, in order to secure the same length of primary saturation for the short and long firing intervals.

A small variation in a cam of this type will cause consider-

able variation in the synchronization and timing of each cylinder. By means of a small light bulb and jig which carries a modified protractor, the exact time of the spark is noted by checking against the protractor. Small variations can be corrected by honing with a carborundum stone, but if the error is more than 5 deg., the cam is condemned.

When the carbureters reach the carbureter repair department they are dismantled and cleaned.

Units Ready for Assembly

The float level is determined and reset if necessary and other jets are installed. The old jets which were removed are given a calibration test which is done by measuring the amount of water that will flow through them in a given time with a given head or pressure. Providing the jets show the proper flow for a certain size of opening, they are tagged as O. K. and are used on the next carbureter.

The completed ignition system and carbureters are turned over to the mechanic in charge of the crew, who now has all the units ready for assembly. The foreman or inspector in charge of the floor usually comes around at this time and personally inspects the crankcase assembly.

(Instead of some of our service shop foremen sitting in their office wrangling with some irate car owner it probably would be much better were he to don a pair of khaki overalls and personally look each job over. He would have less explaining to do to the customer.)

If no cotter pins are missing and if everything is just right the crew chief is given the O. K. to go ahead with the assembly. Although the threads on all bolts and screws are very closely fitted so that the nut will not rattle off, the omission of a cotter pin is looked upon with something akin to horror. "Good enough" is a word that is not heard around the shop and no chances of failure are courted by forgetting to put in a cotter pin.

(Who has not stood around a service station and many a time heard the expression, "That's good enough. Let her go at that." As long as we are agreed that the customer is the meal ticket for the automobile dealers' service station, can we afford to talk that way? The service work on his car cannot be done too good if his future good will and business counts for anything.)

The assembly proceeds after the proper arrangement of hand tools and parts secure. The cylinders, if they be of the individual type, are laid out in their proper order. A vessel filled with hot lubricating oil is placed within easy reach. The aluminum pistons are allowed to stand in this hot oil until they have become warm. The warm piston is then ready to receive the piston pin which can be readily inserted by hand.

The warming of the piston expands the hole in the piston boss sufficiently to allow the piston pin to be inserted easily without using a hammer. Blocks are placed between the piston and connecting rod to prevent the piston from slapping against the rod during assembly. The cylinders are loosely bolted down and are tightened after the intake port faces have

been aligned by means of a long straight edge. Shellac is not used on gaskets and it is necessary to have all of the intake port faces in perfect alignment to prevent air leaks. Installation of the camshaft assemblies follows and the engine is ready to have the valves timed.

Valve timing on an aviation engine is done in somewhat the same manner as on an automobile engine, although the exact methods are slightly different. Each cylinder is individually timed instead of one cylinder as is done on the automobile engine. The absence of a flywheel, with its convenient valve timing marks, necessitates the use of what is called the timing disk. This consists of a disk of sheet metal of a given size which is provided with elongated holes at its hub and which is bolted to the propeller hub on the crankshaft.

The valve timing marks which are designated on the rim of the disk are similar to the valve timing marks on the conventional automobile engine flywheel. The exact upper dead center position of No. 1 cylinder is located and the disk is then permanently bolted to the propeller hub, with the "U. D. C." mark on the disk exactly in line with the hand or pointer which has been previously fastened to the crankcase at a point exactly in the center line of each bank of cylinders.

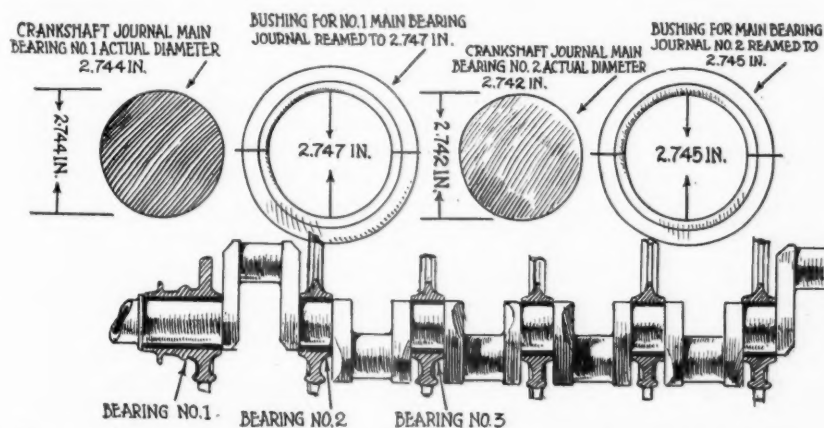
The valve tappet clearance is set at the required distance, which is .015 and .020 for the inlet and exhaust valves, respectively. The crankshaft is turned until the mark "Exhaust closes" is in line with the timing arrow. The camshaft gears are then meshed with the exhaust valve on that cylinder just closed. The exhaust valve point of opening is then checked with the disk to determine that no error exists. The opening and closing of the inlet valve are checked in like manner. A variation of 3 degrees on the opening or closing of any valve is the maximum allowance. Any slight error is compensated for by honing the cam in question.

Running-in the Assembled Engine

Each cylinder is put through the same procedure and if any existing errors cannot be eliminated by honing or dressing the cam, the entire camshaft is rejected. The timing of the ignition is accomplished in the same manner, although the uniformity of the interrupter cam had been previously inspected and checked by the electrical repair department.

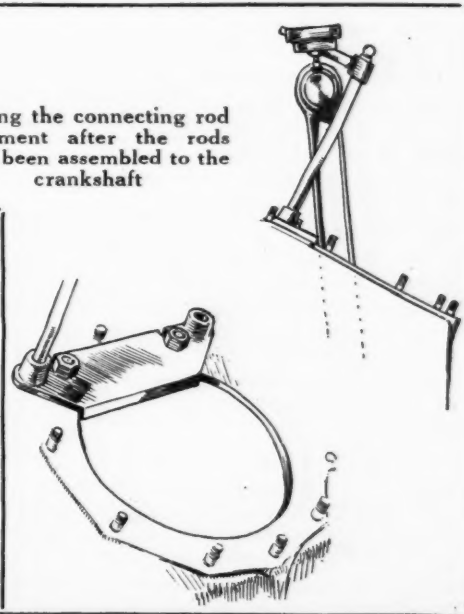
These apparently unnecessary operations afford a method of checking and rechecking which tends to secure reliability and insure a really smooth running engine. The spark plug electrode gap is set on all plugs by the use of the feeler or thickness gage.

After assembly and another overall inspection the engine is sent to the limbering or running-in stand, where it is belted for five hours. The oil used during the running-in operation is drained and the engine is sent to the block test. A certain set program is followed on the test block. The engine is run



The crankshaft main bearing journals may vary a few thousandths in diameter. Individual cutters on the line reamer are set so that each set of bushings is reamed to fit its particular journal. By this method all bearings are absolutely in alignment and all have uniform clearance regardless of the journal diameter

Testing the connecting rod alignment after the rods have been assembled to the crankshaft



for two hours at approximately 700 revolutions, for three hours at 1,000 revolutions and for half an hour at nearly full throttle.

Although no dynamometer is usually available, a careful record of the fuel and oil consumption is kept. This is done in most cases by having the fuel and oil tanks mounted on a weighing scale. The reading on the scale at the beginning of the test is checked against the reading at the end of the test and the consumption in pounds is noted. Certain standards of performance are adhered to, especially regarding the maximum revolutions of which the engine will turn. The oil pressure must not rise or fall from a certain set standard, neither shall the fuel or oil consumption exceed the set standard.

(Regarding the consumption of fuel and oil it is worthy of note that although automobile engine makers boast of the economy of their engines in this respect none of them specify the actual consumption in pounds of fuel or oil per horsepower hour.)

A true gage of the fuel efficiency of an engine is available when this information is known. A sample of the test card from an airplane engine would read something like this:

Engine No. 3456
Maximum H.P. 440 at 1675 R.P.M.
Fuel5 pounds per B.H.P. hour
Oil 037 pounds per B.H.P. hour

Providing the engine on test has successfully passed the maintenance department requirements it is tagged with the necessary data and with its own log book is placed in storage. The tag fastened to the engine carries the name of the block tester and the crew foreman who overhauled it.

The Human Element to Be Considered

When the operation department requires a replacement engine they secure it from storage. Before installation, the engine is inspected by the chief mechanic of that department or one of his aides. Under his direction the engine is given an additional run on the ground of about one and one-half hours, after which the assembly is again inspected, and if found all right is marked "fit for service."

It will be seen by these few glimpses the necessity of perfected service if reliability is to be assured. The human element is of more importance in aviation than in the automobile field of service. The operator piloting a heavier than air plane is a final application of the human element in aviation. After he has left the ground in his ship he has no one to lean on for moral and physical support.

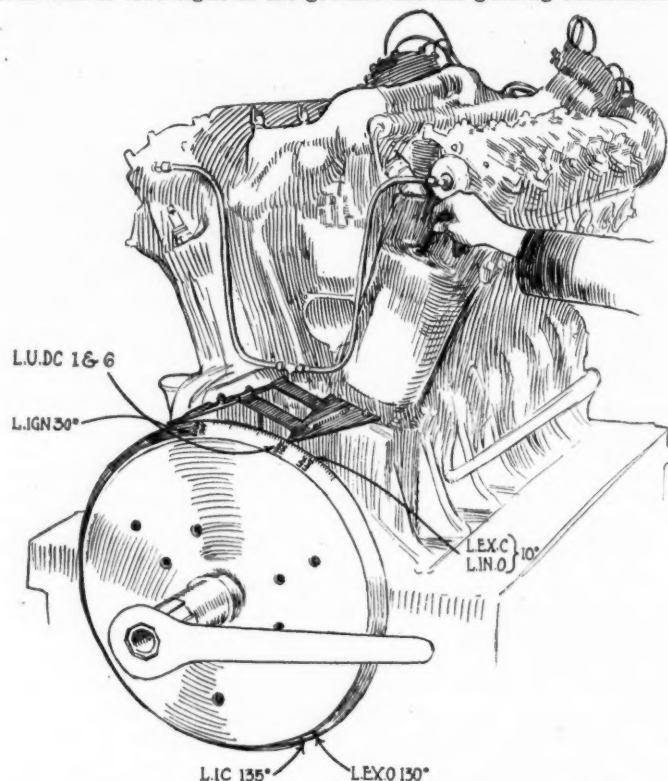
He must do his own thinking and he must think correctly. He must act when it is time to act and his actions must be precise and positive. The keeping of his own life and a costly piece of mechanism and a valuable cargo are in his own hands. No flying organization is any stronger than its weakest pilot, for it is in his hands that the efforts and achievements of the remainder of the organization are placed for efficient disposal.

The aviation branch of the automotive industry has before it many difficulties to surmount before it can equal the performance of the automobile in regard to reliability. These difficulties are not all inherent in the airplane itself but are caused from other conditions. These conditions include the lack of adequate airdromes, and well marked aerial routes. Well marked routes are essential for the success of night flying, and on night flying depends much of the success of the commercial side of aviation.

The airplane means a gain of nearly two business days in the transportation of mail from New York to San Francisco. This gain could be doubled if conditions were such that night flying would be practical from a standpoint of safety. To secure the element of safety it is necessary to develop efficient and simple methods of illumination for the airplane in case of an emergency landing due to bad weather or mechanical trouble.

Among the things that constitute bad weather there is nothing more detrimental to the adherence of scheduled flying than fog. The ill effects of strong winds and rain have been practically eliminated by the advent of the better designed high powered type of airplane, but the presence of fog presents a problem that is yet to be solved. Fog has a detrimental effect on the operation of most every method of transportation, but

it is more marked in the case of airplane transportation. This is due to the fact that the airplane operates at higher velocity than other methods of travel and also because to fly above it means to lose sight of the ground and all guiding landmarks



The timing disk is to the aircraft engine what the flywheel is to the automobile engine. Each cylinder of each bank is individually timed for ignition and valve setting. A system of lights is used to secure synchronization of the interrupter points

and to attempt to fly below it is dangerous on account of the fact that it is perfectly possible to collide with the side of a hill, a smokestack or a tree.

At first glance the question arises as to why the compass is not adequate enough to permit flying above the fog. It is, but it will not tell just where the ship is in relation to any certain spot on the terrain below. Even if the approximate location is known, it still remains that to reach the ground it will be necessary to point the nose down and trust to Providence.

Developments of Mutual Benefit

The things desirable in the airplane of the future are a simpler and longer lived structure and greater flexibility of maximum and minimum speed ranges. Which means, for one thing, the ability to take off from and land on a smaller area of land or water. There must come also a reduction in the cost of operation and maintenance. The perfection of the power plant probably will come about by a closer relationship between motor vehicle and airplane power plant manufacturers.

Although the requirements may differ in some respects, the developments in either branch will be of mutual benefit. This same interrelation should exist in the service and maintenance departments of these two branches of endeavor. The exchange of ideas and comparison of practices will be of direct benefit to the automotive industry.

The Allgemeine Electricitäts Gesellschaft manufactures a little device suitable for electrically burning names, marks, etc., on tools and other metal parts, using electric current at very low tension. A small transformer produces a current at 1.5 volts. One terminal is connected to the part to be marked, and the other to a pencil with copper point. Upon writing the name, etc., upon the tool with the pencil the mark is melted out by the electric current. The tool requires no special treatment either before or after marking and the cost of operation of the device is low.

Selling the Industry to the Home Town

APPECIATION DAY was a feature of the Quincy Automobile Show this year. The effort was not to gain a few paid or free admissions to the show, but it was taking advantage of the opportunity to properly present the industry to the industrial groups of the city.

The big events in this effort were the beginning of the program several weeks in advance. The automotive member of the Rotary, Lion and other trade organizations was pepped up a bit to make himself more prominent in affairs of his club and to lead up to this occasion. Automotive matters were brought up in the Association of Commerce and generally an introductory program was carried out. Then a folder was printed which is reproduced below. The first page of the folder was based on the show. The fourth page was a list of the

members of the Quincy Automobile Trades Association.

The climax of the campaign came in the annual dinner of the Trade Association. Chief officers of all other industrial associations were guests. Each member was responsible for bringing his banker or a representative of his bank to the dinner. The addresses at this banquet were on the importance of automotive transportation and those present were warned against patronizing car, maintenance and other dealers who were not big enough men to belong to the association of their industry. The expressions after this dinner indicated that the results were very satisfactory.

It is not necessary to have a show to stage this program.

FACTS ABOUT QUINCY'S AUTOMOTIVE INDUSTRY

The following figures are compiled from dealers in automobiles, trucks, equipment and service only. They do not include gas and oils. Neither do they include motor togs, tools and supplies sold by stores other than recognized dealers in those lines. Neither do they include money and labor spent for private garages, their drives and upkeep. Nor any of the other business activities created by the automobile.

Annual volume of sales in Quincy,	\$4,868,000
Annual pay roll in Quincy,	392,500
People employed in Quincy,	322
Annual rentals paid in Quincy,	34,000
Capital invested in Quincy,	1,200,000

In Quincy's immediate trade territory (30 miles) there are TWENTY-THREE THOUSAND automobiles with passenger capacity of over 100,000 people.

NINETY-SEVEN PER CENT of out-of-town shoppers come here by automobile.

Automobiles and trucks are the ROLLING STOCK that make our highways more valuable than railroads. They bring the buyers and deliver their purchases.

The car owner comes to Quincy ten times as often as the man who does not own one.

Every out of town shopper brings a NEW DOLLAR to add to the working capital of commercial Quincy.

Every NEW CAR sold in Quincy trade territory gives one more family a new means of reaching Quincy business houses.

Without any appreciable increase in population Quincy's volume of business has increased at a rapid rate during the past few years. How much credit is due to the automobile?

The Quincy Automobile Trades Association, a part of Quincy's commercial fabric, is rendering a service to Quincy in promoting the automobile business and keeping it on such a high standard.

It has attracted favorable attention to Quincy from organizations in various parts of the country, on convention floors and in National publications in numerous instances where it has been credited with introducing new and valuable methods and DOING THINGS.

This Association believes that the Automotive Industry is APPRECIATED IN QUINCY and has therefore set aside Thursday, March 30th as APPRECIATION DAY at the Auto Show.

We believe that every business man will show his appreciation by ATTENDING THE SHOW on this day.

Attendance at past shows has been nearly NINETY PER CENT from out of town. If this is reversed on APPRECIATION DAY we will know that the Automotive industry is appreciated in Quincy and enter into the spring business with a greater determination to progress.

Have You Compiled Similar Figures for Your Community? They Are Easily Obtained

The Fable of the Guy Who Found Out How to Cash-In on His Front

WITH APOLOGIES TO AESOP AND GEORGE ADE

ONCE there was a Sweet Cookie. Her godparents had unanimously decided upon Jane, but nobody held that against her, for as has been said somewhere before she was the Pastry. Recognizing this indisputable Fact, the junior members of the Local Masculine Gender were Active in her Interest. One in particular, who had been christened Waldo, but had licked all his schoolmates into recognizing him as Mike, was particularly free with his Pocket Money.

Yet useless were his Sacrifices, for when he rose in Meeting and made the Momentous Motion, he not only found no Second, but was Howled Down. In a word he received the Fingerless Glove. Jane's philosophy ran thus: "I am possessed of the Goods. They all flop at the first look—why Deter them? If one does, all will. On with the Dance."

So the Embittered Mike sought solace in the Garage Business and settled down, if that can be called settling down. With the aid of a couple of Faithful Grease Hounds he worked hard at pumping gas and screwing nuts 14 hours a day and gradually built up enough trade to keep a jump or two ahead of the Sheriff.

Working Hard was not the Candy to Mike, however, and he rang every Bell in his Belfry loudly and often hoping to Signal the Good Fairy who takes one by the hand and leads him to the Berries. Finally in the midst of a Tea Party at which he Poured and at which all the Glooms were Guests of Honor, he remembered Jane. He was just speculating as to why he hadn't Bumped Himself off as he had promised when sud-



Jane was deeply in debt to Melba and Ed. Pinaud when he loved her

denly, the Glooms gave place to Rosy Light, Quivery Music, Faint Perfumes and the soft jingling of Silver and Gold. He had Tumbled to the Truth of Jane's Line and the Effectiveness of her Methods. "Jane was Right!" he thought; "I must Cash-In on my Front."

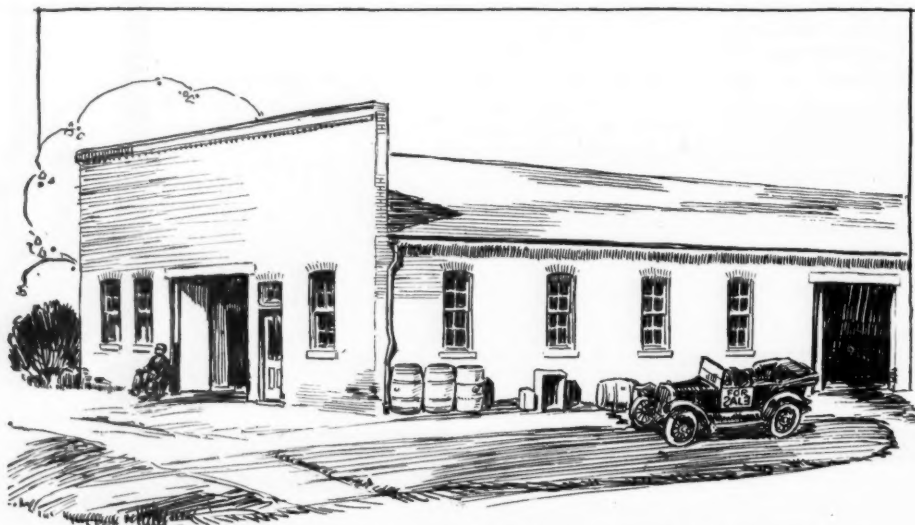
The Hunch became Poignant when one day he overheard his Place of Business

referred to as "Mike's Dump." With the Iron in his Soul he hesitated no longer but hastened to the Temple of

Mammon where the Community Shylock taxed him Nine Per Cent per annum for the privilege of Doubling his Indebtedness.

From then on there was something doing around the Punkville Garage, for that was the Official name on the Letterhead, in spite of local gossip to the contrary. Mike retained all the architectural Milliners and Dressmakers he could Round Up. He invested in plate glass, tile flooring, indirect lighting, illuminated showcases, leaded glass partitions, electric signs, self opening doors, shrubbery and brick walks between the building and the "Turnpike."

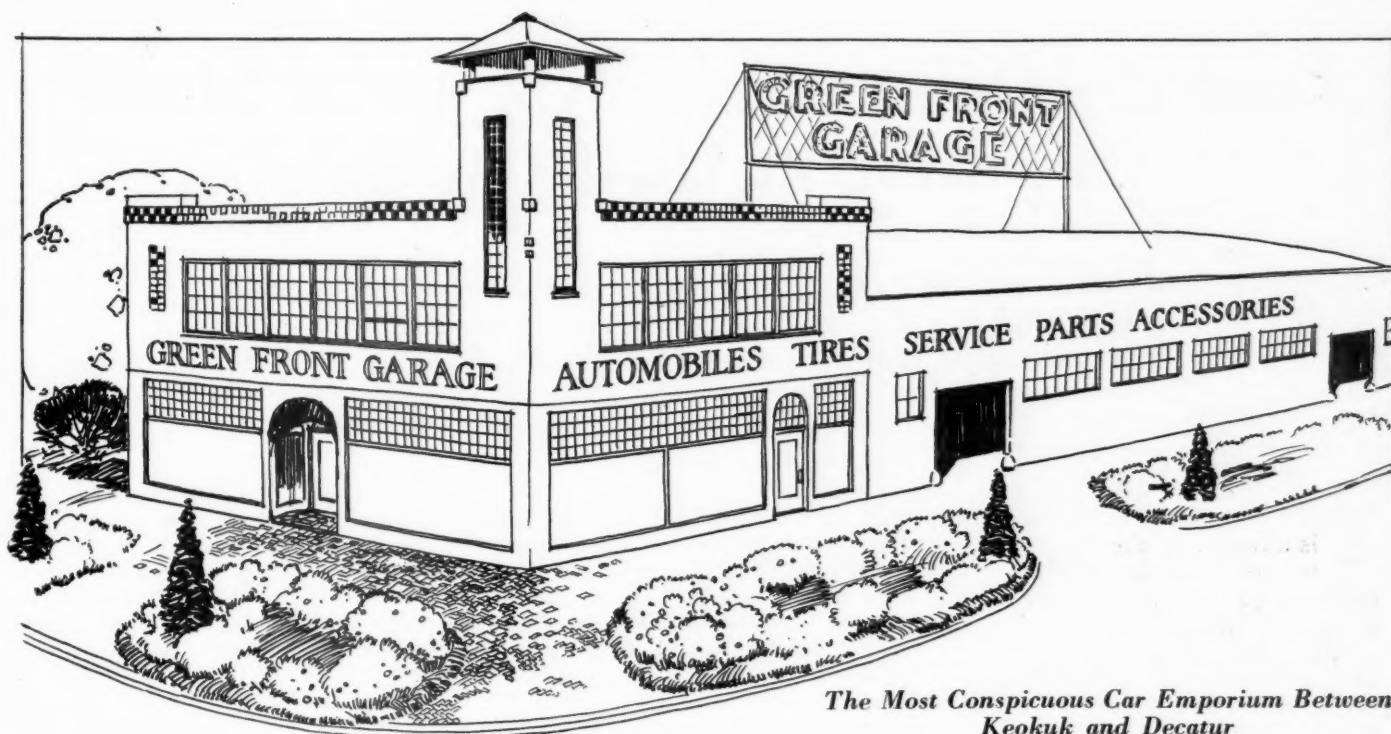
Green tinted stucco decorated with green and red tile hid the old rough brick, in fact, he did everything to make his Dump the most conspicuous Car Emporium between Keokuk



The Punkville Garage, commonly known as Mike's Dump



She was decidedly on the Toboggan



*The Most Conspicuous Car Emporium Between
Keokuk and Decatur*

and Decatur. He didn't stop there either; he Dolled Up the Nut and Grease Fighters in green suits and built a big green service truck without any muffler and kept it out Burning Up the road for the express purpose of advertising the "Famous Green Front Garage."

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Business came in Fat Gobs and the tinkle of the Cash Register was from Dawn to Midnight. He realized more than ever that "Jane was Right."

He was now "Cashing In" on his front to the full extent of his territory possibilities. This was true all summer since the Green Front was Moved on a Main Highway, and no tourist dared pass without giving the Green Front the Double O, but business Went Down with the Mercury in the Fall and sometimes fell off till there was hardly a job in the shop.

Something must be Flooeey, the territory was rich, there was plenty of winter driving, there should be plenty of winter overhauling, the Famous Green Front Garage should get the Glutton's share but somehow it drifted into other shops; the local Wiseacres didn't seem to Crave Green Clad service so much as did strangers.

At this perilous Juncture business took him to the Abiding Place of his First Love, and of course, he called to see if the Years had wrought changes. He wondered, too, if the Business of Vamping was steady or fluctuated like the garage business. When his call had lasted 98 seconds Mike sadly realized that all is not Aged in the Wood because the Label says so. She was deeply in debt to Melba and Ed. Pinaud when he loved her. Now he found her in a State of Peonage. She needed her Vanishing cream as a Celestial desires his Pipe of

Hop. Without it she was nothing. With it she didn't total more than one Place to the left of the Decimal Point. The Canary grew dumb at her Entrance, and the Cat sought the friendly Shelter of the Base Burner. When she walked abroad women called her "Dear" and men became Absorbed in Political Argument. Children scurried to their mother's Skirts—lee side. She was decidedly on the Toboggan with Downs more numerous than Ups. "Here," thought our melancholy Hero, "Beginnith the Second Lesson. The hunch was Good while it lasted, but was Short on Durability, a collapse like hers and I'd be All to the Auctioneer. Perhaps I am

devoting too much attention to Harpoon-ing trade or at least not enough to Making it Fair to the Craft, and on the way back in the Smoker Mike twice overlooked a Hundred Aces and thrice overbid his Partner when the Enemy had Quit.

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TNT was Malted Milk compared to Mike when the Force assembled next morning. "Hereafter," declaimed he, "anybody coming to Work with his Nails Manicured is to observe the Sign out in front which says Help Yourself to the Air. Five Minutes ago this place quit being a Lounge and became a Workshop. Anybody caught reaming bearings with a Cigarette Holder will be shown the Error of his Way, and if another customer goes out of here Dissatisfied, he'll be walking right behind the Man Wot Done it."

Mike put it crudely, we must Admit, but the End justified the Means.

He put himself in the shoes of his customers and stood there until his Feet hurt.

He changed his method of handling accessories and parts to the effect that customers soon came to him for all their Needs instead of for those things they couldn't get elsewhere.

With the Operatives all Pepped up and the Boss in front Cashing In on the "Ask 'Em to Buy" Idea, the Belting began to wear on the Lathe, and the Cash Register suddenly recovered from a threatened attack of Articular Rheumatism.

Thus his flashy, Tourist Fleecing, superficial business gradually assumed solidity. The Front brought them in and his treatment made them friends.

*Moral—Beauty is only Skin Deep;
to make good a girl must know how
to Fry Bacon.*

For Better Customer Contact

To Employees:

Who is the Boss Around Here?

He is the person who has come to this building to be served, if he buys a cotter key or a seven passenger sedan, it matters not. He is the boss of this place while he is here and he is to be shown every courtesy possible and your time is to be his time until his wants have been fulfilled.

To Serve right—is to build.

We have built this institution on real service intelligently rendered at the least possible cost and to further this organization your assistance is needed. We want you to realize just how important your position is and how much we consider your judgment.

Our policy must prevail, you are working under certain rules, no real customer will ask that you vary from the same, but instead assist you so that your work and my work will continue to be a real pleasure.

Lest the boys in the organization forget where their interests truly lie, this notice posted on the bulletin board serves as a friendly reminder and tells who the real meal ticket is.

Dealer's Ability to Analyze Local Market Is Factor in Used Car Sales

*Both Used and New Car Sales Are Based Largely On
the Retailer's Knowledge of Buying Possibilities in His
Community; Conditioning Used Cars Figures in Sales*

By HARRY TIPPER

Written for Automotive Industries

THE market for the automobile is affected by the entire consideration from the time the automobile is produced to the time when it reaches the junk pile. The size of the total car population in any locality is directly affected by the service rendered by the automobile and the valuation placed upon it at different stages in its usefulness.

So long as the possession of a car was the most important reason for the distribution of automobiles, there was no great tendency to consider intimately the cost of its operation nor the depreciation in its value. As the car population has grown, however, until the car has become familiar and most of the new car buyers have previously owned vehicles of this kind, the cost of operation and the depreciation in value become more important. For the great majority of the people in this country the original investment in the price of a car is not so important as the amount of money which must be paid out each month in order to keep the car running. This relates not merely to the new car but also to the second-hand car and its operation.

Market Affected by Life of Car

The total volume for new cars is related to the life of the vehicle, and also to the second-hand valuations. It is obvious that the market for new cars of any particular manufacture is affected by the life of that particular car and the service it will perform in comparison with its valuation when it is transferred second-hand.

The manufacturer of automobiles, therefore, is intimately interested in the problem of valuing and disposing of used cars. The flow of new cars into the market must be regulated to agree with the flow of second-hand cars from buyer to buyer until they are junk. If there is any hesitation in the transfer of the vehicles at any point along the line, this

will show itself in a lessened market for the new product, sooner or later, as a consequence.

It was stated in a previous article that the market conditions had not required a valuation on the part of the public as to the new car in relation to its service. Only lately has the buyer of a new car compared values with services for his particular purposes. The same thing has been true in the used car market. So long as the production was not sufficient to meet the demand, the used car sale was an individual matter between the buyer and the dealer. It represented no great comparative examination from the standpoint of service and it was not subject to the conditions of depreciation imposed by such valuation.

The general tendency must be for used cars from any given price group to come within a reasonable comparative value—type, make and model considered. At present this is visible only as a tendency. The prices asked for used cars show an unstable market and a variation in valuation which does not aid the flow of the product, but which has a tendency rather to slow up the process through which the automobile must complete its usefulness and reach the junk pile.

Every car that is being used by an individual owner, whether he has bought it new or second-hand, brings him into the business as a probable permanent customer for cars, or tends to drive him out of the business because of the difficulties imposed upon him by his first adventure. No matter what price may be paid for the used car, it is of no value unless it is in a condition to give service. No matter from whom it is bought, some of the difficulties that may be experienced reflect back upon the maker of the car and affect his market for the new products. It is obvious that the trade-in feature of the used car problem has affected the values and left the dealer in a position where he has paid more for such cars than it is possible to secure for them. It is obvious, in other words, that the trade-in has created a fictitious value in many cases for the used car and has slowed the

progress of used car sales because of the loss entailed in moving them rapidly on to the market.

While this problem, of course, is a problem of the dealer, in the usual interpretation the manufacturer's market for new products is so intimately affected by the conditions operating in the used car field that it is necessary for him to advise with and co-operate with his dealers in the endeavor to put this proposition upon a more stable foundation, so that the market value can be determined within reasonable limits and the conditioning done on a reasonable basis.

The Problem In Other Fields

Similar problems have been met in other fields in their history of development, notably in the typewriter field, where exchange has persisted for a great many years. In the course of its development the typewriter field has progressed to the point where a typewriter has a valuation in proportion to its age and model, without much regard to its particular condition. It is likely that the tendency in the automotive field will be to establish valuations more in accordance with the year and type of a car, the make, etc., and less in accordance with the particular conditions of the individual car taken in.

It is unlikely that trading will decrease to any great extent in the near future, but it is probable that such trading will have to be done on a basis of more accurate general valuations which will permit of the proper conditioning so that the used cars will be serviceable when they are bought. So long as a car is being run with the maker's mark on it, to be recognized as the production of a certain factory, the service of that car is important to the manufacturer because it is affecting the opinion of some car buyer and reflecting upon his possible new sales. In the history of its progress any individual car passes out of the control of the manufacturer or his dealer, although its influence upon his future sales continues until it is junk. As a consequence the manufacturer is closely concerned with the ability of the dealer in the automotive field, the repair shop and the service station

to value a used car properly, to sell it in such a way as to permit conditioning and to give a reasonable amount of service.

Effect of Used Car Sales and Trades

The present acute condition in the used car field is due mainly to the anxiety of the dealers to sell a new car without considering sufficiently the character of the trade and its effect upon the total cost of the business. The fact that the used car would be affected by the same causes which affect the sale of new cars does not appear to have been thoroughly understood, and the further fact that backing up of used car sales must affect the new car market was largely overlooked. The present acute problem will be solved partly by the necessities of the dealer and partly by the effort of alert manufacturers, through co-operation, aiding the dealers to relieve themselves of this difficulty. It is likely to remain a difficulty, however, for some time until the manufacturer and dealer thoroughly realize that the market for automobiles is insparable and that the conditions affecting the market affect the whole market whether the product be used cars or new cars.

It will be a difficulty until the manufacturers and dealers realize that the used cars must be conditioned before being sold if they are to exercise proper influence upon the future sales of new cars of similar make, and it will be a difficulty until the character of the service and the extent of the service in repairs, rebuilding and adjustment are sufficient to take care of the requirements of the field in this respect, so that the used cars may be bought upon a known basis of value and without the suspicion attaching to much of this business at the present time.

This part of the automobile market, although it has been discussed as a separate proposition, really affects the whole question of new car sales, the question of service, the repair shop equipment and car values. It should have a considerable place in the discussions leading up to the contract between the manufacturer and the dealer, and, in the course of time, it is likely that it should have some kind of a place in the contract itself where it relates to those cars affected by the contract conditions. The used car problem is a problem because of the following conditions:

1—The absence of established values so that no buyer is sure that he has received a proper value when he buys a used car.

2—Trades made without reference to the legitimate value of the car to be turned in and upon the individual condition of the car.

3—The sale of used cars without a proper amount of allowance for conditioning so that they would be in serviceable shape when they are bought.

4—The lack of proper facilities, sufficiently widespread in all parts of the country, for the general repairing and rebuilding of used cars so that the service can be extended to them whether they are in or out of production, until they no longer pay for repairs and are ready to be disposed of at the junk pile.

The car dealers in any particular locality must analyze the market for cars for the particular period covered by the contract so that the market analysis takes into account the probable number of new cars, the probable number of trades required and the outlet for the used cars involved in the trades. This requires a much keener analytical consideration of the territory than we have

of the increase in registrations and the condition of the cars owned in that locality would indicate the probable market for new cars. As the increase in registration becomes smaller in its percentage against the total registrations, the virgin market for new cars becomes correspondingly smaller and a larger proportion of the market must come from those who own cars at present. Both new and used cars will be sold increasingly to people who have owned cars previously, and the total car market in the locality is confined:

First—To those who come in as new buyers of cars.

Second—To those who replace worn out cars.

Third—Those who desire to change an older type of car for the improved current type.

In general, in the country this year a great many of the car buyers will be in the second and third classes, and in each case of this kind the used car must be disposed of, either by trade or by individual sale. In any case there must be an adjustment of the new car buying to the disposal of the used cars. There must be a reasonable adjustment of valuations between the two or there will be a backing up, either in the used cars or in the new cars, with a final effect upon the manufacturer's market.

The quotas established in the contracts between the manufacturer and the dealer must recognize the conditions in the locality, and should be established upon a fair analysis of the probable number of new cars required in order to permit the dealer to carry on his business effectively and to keep the business properly balanced.

Used Car Financing Different

From the manufacturer's standpoint, this establishment of a fair quota basis is of great importance because every new car sold without the corresponding flow of the used cars toward their destination as junk will obviate a future sale of the new cars until the choked condition of the used cars on hand is removed. This means, of course, a reasonable valuation, upon a more stable basis of the used car so that it will not involve greater service value than the new product nor materially less service value in proportion. It is a more difficult matter for the dealer to finance himself on used cars, and they must flow in and out regularly if he is to maintain a sound business condition.

To the manufacturer a stock of used cars in the hands of various dealers is a menace to his future new sales. This is bound to happen unless the quotas are established on a careful and reasonable analysis and not merely upon the ability of the manufacturer to force the dealer into accepting the conditions.

In this problem, as in the question of new car sales, the thorough analysis of the territory looms up in importance.

On Having the Old Bus. Done Over

By WALT MASON

MY CAR has stood in solemn state since winter came to pass; but now that winter's pulled its freight, and gentle spring is at the gate, it's time to burn some gas. This morning to the barn I strolled, and looked the tumbril o'er, where it through long months has slept; and then I sat me down and wept; my tears splashed on the floor. I hoped to swell my meager roll when winter days were done; I said, "In spring a patient soul won't have to blow himself for coal, and so he saves some mon. In winter-time he has no chance to salt away a bone; he's always digging from his pants the wherewithal to feed his aunts, and buy the children pone." And now, that spring is here, alas, extinguished are hope's fires; my bank account will cut no grass; I'll have to buy some oil and gas, and costly tubes and tires. My bumboat must be overhauled by skilled and gifted gents; and when they have it fixed and dolled, and with their little bills have called, I won't have 20 cents. For bank accounts all sane men crave, but they are hard to get; we're always planning how we'll save; and when it's time to buy a grave we have to go in debt.

been accustomed to give it, and it requires a more careful consideration of the movement in individual ownership to be observed in that locality.

The dealer cannot maintain his business in new cars unless he can see a clear way to dispose of the used cars involved in the first transaction. New cars may be forced upon the local market by aggressive means of selling, to some extent; but this additional sale will involve a larger percentage of trades and will result in the dealer's failure to dispose of his used cars at a proper rate. In proportion to the number of cars in a community or a territory, the tendency

Building Small and Growing Big

Some of the Principles Involved in Keeping the Floor Space Abreast of a Growing Business With Minimum Cost and Inconvenience in Remodeling

By TOM WILDER

WHEN we were boys we were not all as particular as most boys of today. Many of our mothers made us hand-me-down pants from father's and they were made with "lots of room to grow."

Like Willie's mother, every ambitious and progressive dealer expects his business to grow and would house it in a building with plenty of room for that purpose. In fact, he would have his business grow and develop to the extent of larger and more up-to-date quarters except for the fact of the heavy expense involved in moving, the disadvantage of starting over in a new location and the general disorganization which accompanies each change.

Besides these disorganizing influences, there is always a time after

a new place is occupied when the building is too large for the business, then there is the time when it becomes just right and then it becomes too small. Because of excessive building costs, many prospective builders have come to the conclusion that Willie's mother was all wrong about Willie, but that she had the right idea for Willie's little sister; that it was better to let out the hem as sister grew than to make the dress large in the first place and that a good way to handle the situation was to build a small place and plan to add floors above or to enlarge laterally if the land was ample.

In this way they plan to build as little as needs will permit, have no excess floor space to load on the overhead and incidentally to save money on the balance of the building, which will be con-

structed after building costs are reduced.

The theory is fine but, as usual, there is a fly in the ointment. Adding to a building is usually an expensive operation. It always costs more than is expected, because there is so much removing of old parts, piecing out and patching up to be done. In exceptional cases, bracing and blocking up of walls, costs more than the work itself.

Added to these extras is the cost of rearrangement to fit the enlarged quarters, which to give good balance must be carried to all departments, unless the arrangement has been unbalanced previous to the enlargement.

The Greatest Expense

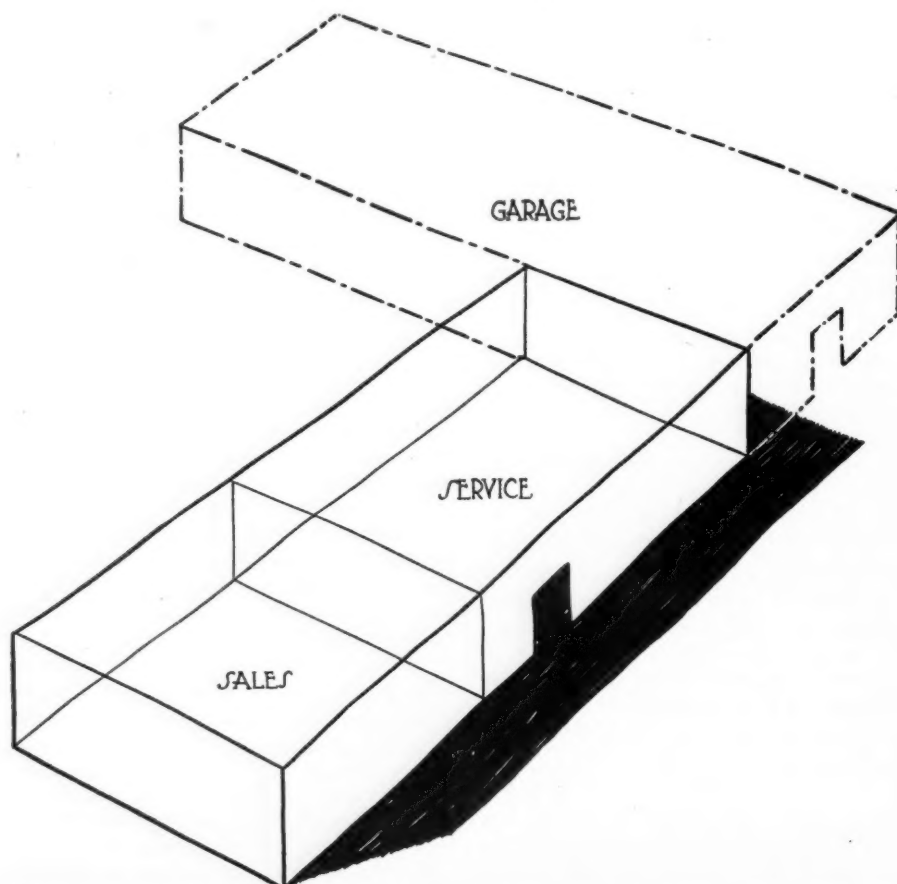
But perhaps the greatest expense of all is that caused by loss of business due to the disorganization; especially is this true when a second floor is added; when a roof is removed and the whole building left exposed to the elements for a considerable period. Planks and bricks fall among the cars, plaster and sand sift into the lubricating oil and permeate the shop generally, till a complete cleaning up is necessary.

Grease-covered parts in the stock room will accumulate a covering of sand which will last until there is a complete turnover. Building to accommodate enlargement requires great skill and foresight. To get good results, several fundamental principles must be observed in laying out the scheme.

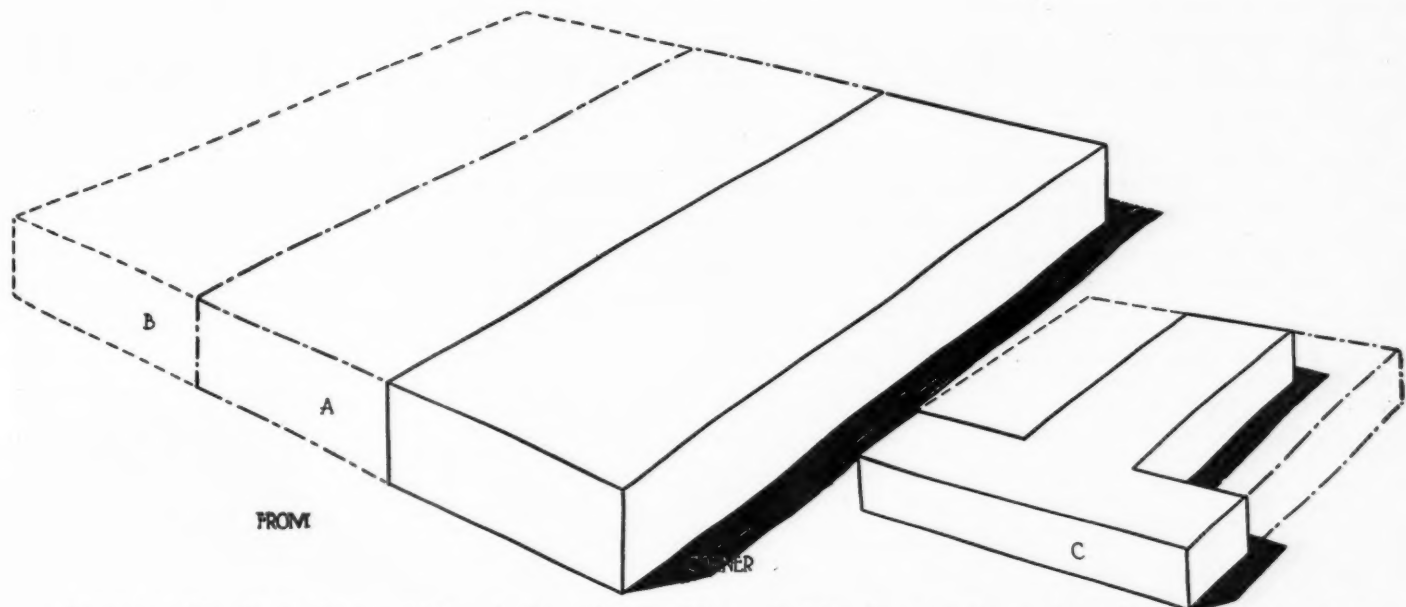
It is well in planning for the future, to make the final layout, even though roughly, in advance, then the building may be developed along definite lines, in one, two or three stages, as the case may be, but always with the least possible discomfort.

This, then, is the first principle in planning such a building and the principle requiring foresight. Of course, it is in reality guessing and if the guess comes out all right, it can be considered foresight. No man on earth can tell just what course his business is going to take; he may start to deal in sales of cars only and end up with 90 per cent maintenance. He must follow the lines of least resistance, greatest profits and economic demands. No one could have foretold the different kinds of trouble the dealers have gone through in the last two years.

The first principle being to plan the finished job, the second one is to plan



When a sales and maintenance organization is to expand for the express purpose of taking on storage, the addition is simple



Expansion laterally on the ground floor is the easiest possible method but does not give such good results in the use of frontage. It is a good method to use in starting on a corner where lots A and B have buildings on them. C is a good method on a large inside lot

the second section so that it will contain all the essentials, present a finished appearance from the front, at least, and permit of additions being made without interfering with business and with a minimum of alterations.

The third principle deals with the nature of expansion and rules that it is more favorable to expand horizontally than vertically, though the latter is possible with good results under certain conditions. Often in horizontal all departments may be expanded equally, which is the best condition, but sometimes in a long, narrow building expansion can be made only in a longitudinal direction toward the rear. This latter condition is not so good since it entails juggling all the departments to give them their percentage of the increase unless, as stated above, some of the departments have been large enough to need no addition.

Maximum Convenience

The diagrams show two of the most favorable methods of building to accommodate expansion. In all of them the building is in solid lines, the first in large dash lines and the second in small dash lines.

Where the buildings are of more than one story it is necessary to design them so the elevator can be included in the original section. It is difficult to do this, but the skill used in doing this kind of work measures the success of the final achievement.

Often it is best to sacrifice convenience slightly in original layout in order to attain it later, though the nearer we can get to continual convenience the better. Aside from the advertising value of constructing the complete front with the first section there is another angle: When any kind of face brick is used it will be found almost impossible to match up the first lot after the lapse of two or three years. Even if the brick comes from the same kiln, clay in the bank

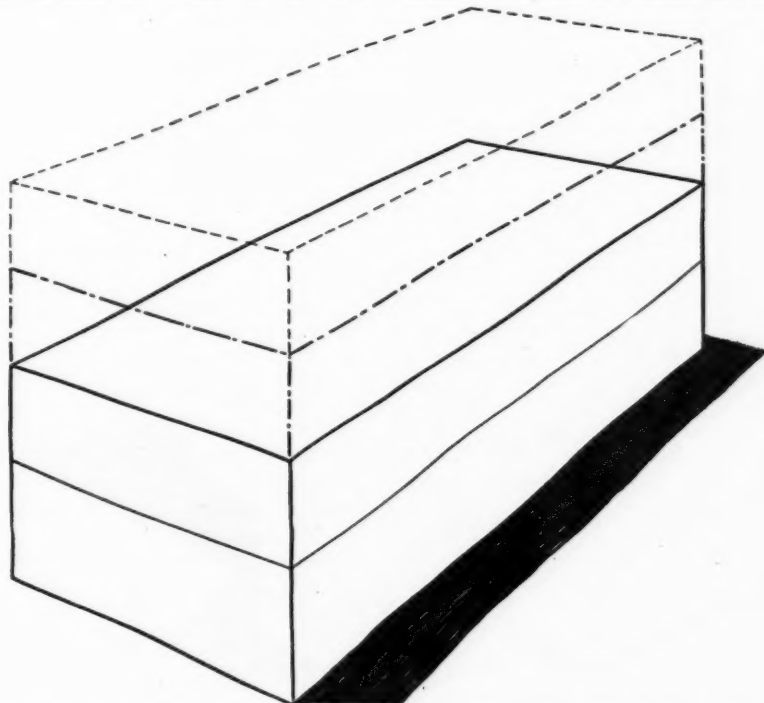
varies so that shades change greatly and there is almost sure to be a distinct line of difference between the old and the new. On account of the space necessary to garage two rows of cars with an aisle between, it can be said that in general sections of 50 ft. in width are the best units to work with both for the original structure and the additions. This width is always usable for garage purposes and it is equally usable for other purposes. If a building is 50 ft. wide and it is extended toward the rear, the size of the addition is immaterial as in this connection width is all that

counts, the only exception being where the building is on a corner and the aisles run crosswise, in which case the 50 ft. additions are here desirable also.

Original Section Plan

It is always desirable to make additions in such a way that the garage space is all together, the shop all together, etc., because long aisles or passages connecting different parts are space eaters which bring no revenue and tend to waste much employee time.

In planning the original section one must look ahead and make the aisles as



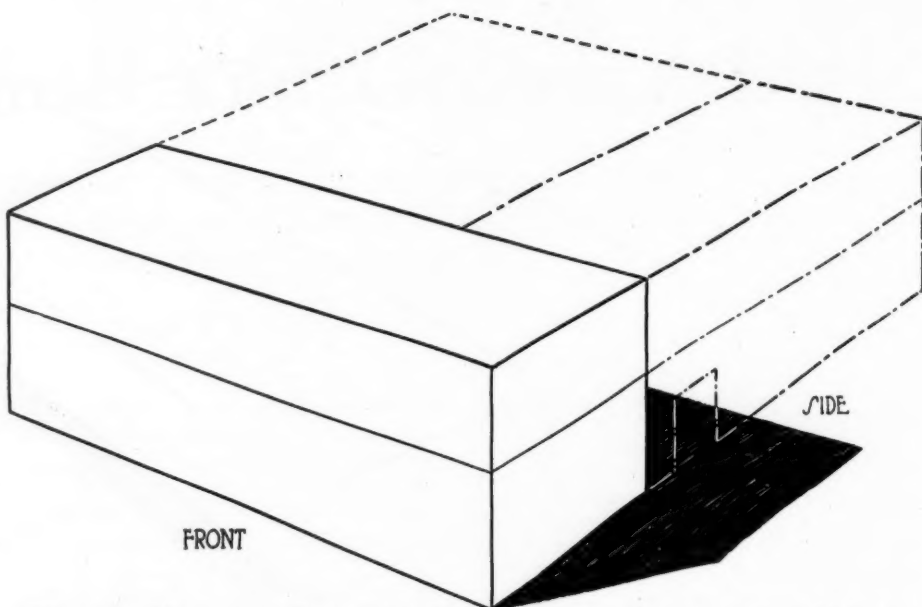
The top floor of a garage building is usually built with a trussed roof to do away with posts. This makes it difficult to add other floors unless the trusses are high enough to permit constructing the floor before the roof is raised. When it is definitely known that more floors will be added, the original upper floor can be constructed as a floor instead of a roof and waterproofed to serve as a roof. In that case it must be provided with drainage

compact and as direct as possible so that the above conditions will not be found to exist when the additions are made. In fact, aisles are very important; they form the backbone of the plan. They should always pass through the center of things with some space or department to be reached everywhere from every side. If a hotel corridor had rooms only on one side with blank walls on the other it would be only 50 per cent efficient. The garage corridor or aisle is no different.

Since it is not the purpose of this article to deal with additions to old buildings, nothing will be said in this line, but if by chance old buildings have been so planned that they court additions, there is no reason why the principle here stated cannot be applied.

As stated above, the first essential in planning for future expansion is to make a general layout which will in a measure express the finished job which may be expected to be occupied some years hence. There must be a sales unit comprising show rooms, offices, accessory stores and all the allied activities. There will probably be a garage unit used either for public or private storage or both. And there will be a service unit comprising various shops, service manager's quarters and office space for receiving and delivering cars, etc.

Since there is no definite balance between the various departments, every man having his own pet methods and one specializing on this and one on that, it is impossible to lay down any hard and fast rules. In general the front of the building is reserved for sales, the center, where light is poor, is given over to car and part storage, and the rear, with light on the alley, is best for shop purposes.



When a building eventually is to be rather large and two stories or more high, it is far better to build part of it the full height and add the future sections the full height. This is much better than building one floor and adding a second later. By completing the front first, the full benefit of the frontal display is obtained from the start. If on a corner, the side section naturally should be next while the rear corner is last.

Where more than one floor is proposed the top with the advantage of good light and air must be used for shop purposes. If more than two floors are contemplated the second, which will be more or less dark, and the rear of the first will handle storage.

Departmentizing in Small Quarters

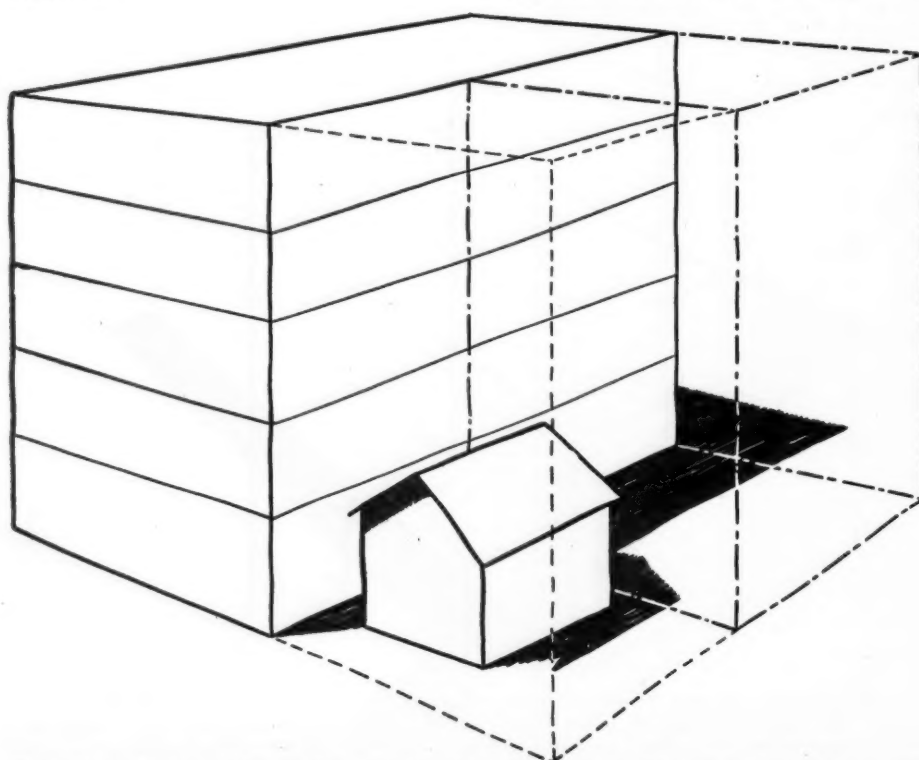
When the start is made in very small quarters not much departmentizing can be attempted, but the space used as opportunity will permit. The office and salesroom will, of course, form one unit

with all the other departments in one room serving as garage, service shop, parts and accessory stock room, etc., parts and accessories often being kept on a balcony to save floor space.

When the final achievement is to be two or more stories, the initial structure should be the full height with elevators and stairways installed just where they will be in the finished job. This way causes slight inconveniences at first in a few cases and necessitates a slightly larger initial structure, but the saving in the end will be well worth the extra cost in the beginning. Temporary outside walls may be built of hollow tile laid in lime mortar. When the new outside walls are completed, the tile is easily removed in perfect condition for future use.

Where property is very limited in area and very valuable there is, of course, only one direction in which to go and that is up. The difficulty here is that since the shop should occupy the top floor to cash in on the light, every addition means disarranging the shop and moving it to the new top floor. This is the most expensive as well as the most disorganizing type of addition that can be made. It is thought by many to be preferable to build a moderate sized building which can eventually be used for all sales, though at first housing maintenance also; then when the time is ripe a maintenance building can be erected in some less expensive locality where the burden of overhead will be less, the space more adapted and the location just as convenient for the customer.

Whatever the prospective dealer does if he hopes to make future additions, he should not build at random but should have a definite plan to work to, not the catch-as-catch-can methods of one who has no thought for the future, but should have a nice wide hem in Willie's sister's dress.



Many times legal tangles or the unreasonable will of some old man or woman prevents acquiring the necessary property for expansion until a term of years has expired. Often it is possible to build around the obstacle

Who Are Selling the Tractors Today?

HERE is an analysis from a Salesmanager for a Tractor Manufacturer. One Fourth of His Dealers Are Automotive Dealers. He Tells How to "Cash In" on This New Line

THE question as to who will sell the tractors of the future is far from settled, but it is interesting to hear who is selling them now. The following testimony from Dave E. Darrah, manager of sales promotion for the Hart-Parr Co., bears directly on that subject. One-fourth of Darrah's dealers are automotive dealers. This is part of an address given to the Iowa Motor Trades Bureau:

In the marketing of power farming machinery today there is a change being enacted. In the past, implement dealers have handled a great variety of implements which the farmer knew how to operate. There is no question about it. He has in stock the same old horse-drawn plow that his father sold, the same old harrow; the same old cultivator. You don't need a salesman for these implements. That stuff was "sold over the counter," as we say.

Today we are selling a new idea—power farming. You are giving to the farmer implements with which he is absolutely unacquainted, and which he does not know how to operate efficiently. One of the great tragedies has been the farmer who has been left alone with power farming machinery to operate by horse-drawn methods. It cannot be done. Wherever it has been attempted, tragedy has come to the farmer. So, today, out of the stress and strain of this new period a new type of dealer is coming to the front, a man who is a specialist upon the lines of power farming. We like to call him a power farming specialist dealer—a man who will handle practically only power farming machinery, who knows its every use and how to operate it most efficiently and not only that, he must know how to lay out Mr. Farmer's farm.

This dealer must be able to advise the farmer how to do away with the small fields, lay out large fields on the farm and give the power farming machinery a chance to operate. He must know all the lines of work that the machinery will do. He must be able to show the farmer in actual terms how to secure increased production, get his crops planted, harvested and marketed on time and make profits.

To do that, a power farming specialist dealer must know more than just sales methods. He has to know more than the average county agent, in my opinion, and I often think of the power farming dealer who has acquired such knowledge and who is using it as being more than a merchandising firm in his community, for he holds the chair of power farming in the university of his community. Do you get what I mean?

Service Is Bigger Thing Than Repairs

This is the age of service. You men today know mighty well that unless you can render a definite service to the client to whom you sell, your business will not last twelve months. Service is not selling alone; you must render service in showing how to use the machinery you sell. You must help your customers to view their opportunities with hope and vision.

Service is not repairs, necessarily, or garage work. It is a bigger thing than that. This specialized power farming dealer today occupies just such a place in this new business. The power farming dealers who have followed this line of selling are today making a success of their work. You'd be surprised that in our organization in Iowa, over one-fourth of the tractor men are automobile dealers, handling automobiles, who have departmentized their work so that the department which handles power machinery is absolutely separate from the automobile department. The man in charge of that

department is an expert who has specialized in that kind of sales work and handled that absolutely separate from the automobile work. You can't mix the two, although they both belong in the line of automotive equipment that the farmer needs. The sales arguments are different—the service is entirely different. You render your automobile service in your garage; your tractor service in the field. There is an entirely different kind of equipment—a different kind of schooling.

I have mentioned three kinds of power farming dealers—the specialized dealer who handles only power farming machinery; the departmentized specialized dealer like many of you who handles your automobile and tractor business by departments, with a specialist in charge of each and the old line implement dealer who handles all kinds of farm machinery and specializes in none. Just to show which dealers are the most efficient in selling, allow me to quote a few comparisons from our own field organization, which has all three types of dealers in it. In 1920 we made a careful analysis of our field sales with the following results:

In our dealer organization of some 1,200 dealers, specialized power farming dealers composed 11 per cent of the entire number and sold 36 per cent of all our tractors.

Departmentized power farming dealers have constituted 24 per cent of our organization and sold 33 per cent of our output.

Old line non-specialized dealers comprised the remaining 65 per cent of our organization and sold but 31 per cent of our output.

In other words the specialized and the specialized, departmentized dealers composing together 35 per cent of our organization sold 69 per cent of our entire output. Or, let's get another slant at this by percentages. The specialized dealer was worth 127 per cent more in sales value than the departmentized dealer and 850 per cent more in sales value than the non-specialized, old line dealer. If any figures were needed to prove the value of specialization in sales, I believe our experience as just given will turn the trick.

Educating the Tractor Owner

As manufacturers of, and dealers in, power farming equipment, we believe unless we can educate the owners of power farming equipment so that they know how to operate and service their machinery within certain limits, and how to make a success of it, we will never get far. The minute you make a farmer independent with the tool which you sell him, the minute you make a success with it and he makes a profit with it, he becomes a boosting owner and turns other sales your way. It works in a cycle. The dealer who builds up a satisfied constituency of owners, the dealer who will persist, now, in this new power farming business, will succeed.

I just want to leave that thought in your minds. I hope in the days to come that you men as dealers in automotive equipment will gradually broaden out and departmentize your work until you handle practically everything in the power farming line that the farmer will need. It is yours by right because, to my mind, the old fashioned, non-specialized implement dealer, to whom it was first offered, had passed up the thing which was his birthright and clung to the old ideas, until today industry is ten years ahead of him in its conception of the future of power farming. You men, with the training you have had, have this opportunity before you.

Periodic Inspection of Trucks Big Help In Maintenance

THIS Business Has Some Aspects Entirely Foreign to That of Selling Maintenance on Passenger Cars. Service Car Essential Piece of Equipment

THE maintenance of motor trucks must necessarily be carried on differently from that on passenger cars. Trucks are judged largely by economic comparison. A truck laid up much of the time for repairs is naturally considered a poor investment. But this may not be due to an inherently poor design of vehicle, but rather the result of improper attention to the truck.

Several things must be borne in mind when we speak of truck maintenance. For one thing, the truck is seldom driven by the owner, whereas with a passenger car we find in nine cases out of ten that the car is driven by its owner.

Care in Driving Essential

Many managers of truck maintenance stations have told us that the truck driver is one of the most important factors with which the station must concern itself. Let two trucks, both in the same condition, mechanically speaking, go out of the station and in a week, perhaps, one will come back for repairs, while the other goes on for several weeks or more. Why? Just this. The former is driven by a man who is careless in driving, overloads his truck, drives it as fast as he can over any sort of road and pays little attention to the lubrication or adjustment of the chassis.

The man who owns a passenger car wants it to perform at its best and consequently he is more apt to take a little time every week to turn down grease cups, tighten wheel bearings and do the many other little things which collectively make a well running car.

The truck owner also wants the truck to perform at its best all of the time, so far as possible, but where a man might own a fleet of trucks it is almost impossible for him to check up the condition of each one. He may leave much of this to the drivers of the trucks, but they look it over only superficially.

The proper inspection of customers' trucks is one of the best means to insure both owner and dealer getting the best result from the trucks operating in any territory. Of course, some of the large fleet operators have their own maintenance department and call on the dealer's establishment only for parts.

Periodical Inspection

No truck dealer wants to see one of his trucks being towed in for repairs. Trucks are sold primarily to be kept going as much of the time as possible. A passenger car might be laid up for a time and the owner of the car not seriously affected by not having it. But with a truck it is vastly different. A truck only makes money for its owner as it can be kept running and doing work. It is bought on that basis.

To keep a truck on the road as much of the time as possible is

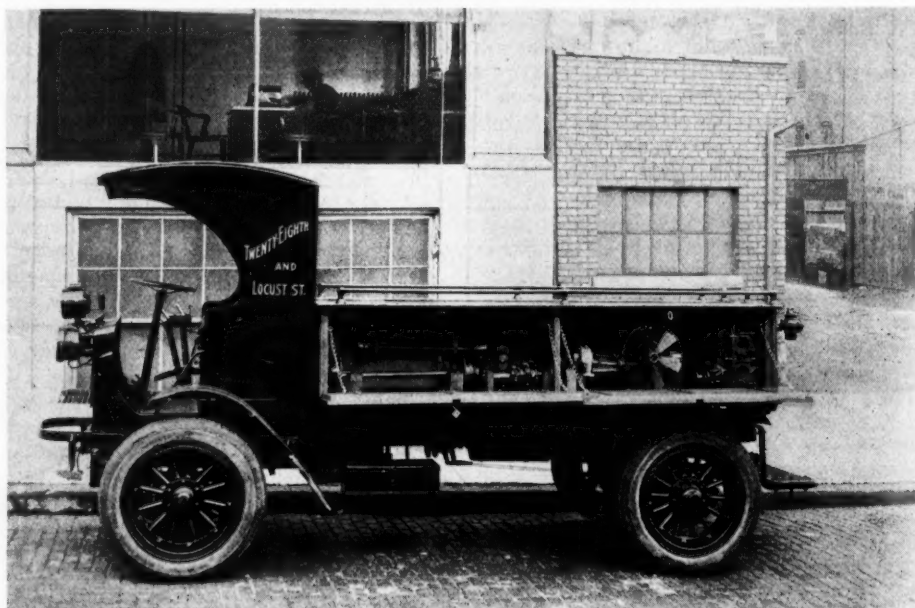
largely a matter of periodical inspection. Inspection at the right time and well carried out will forestall much trouble and lessen the chances of the truck having to be towed in. In nearly every case where a dealer is successful with his truck business we find that he uses some very good system of making regular inspection of all the trucks he has placed in his community. And in almost all cases where a truck owner gets mailed to him a copy of the inspector's report showing the exact mechanical condition of the truck at the time and containing the list of suggested repairs or adjustments needed, he will drive the truck to the maintenance department to have the work done. Truck owners seem to realize that to neglect these inspection reports, will mean failure of some unit at some time on the road and perhaps cause a great loss in time and money.

Truck dealers who have used the periodic inspection system for their customers' trucks have proven it to be very satisfactory. To carry out the idea some predetermined plan must be put into force so that the owner and the dealer will secure the maximum results from such a system.

Mail Report Direct

Then some type of form must be developed which will show at a glance the mechanical condition of the truck and at the same time be educational in its nature for the benefit of the truck owner. Such a form is illustrated on these pages. Other forms which have been successfully used by truck maintenance concerns are illustrated herewith also.

If during the course of the inspection, it is found that some serious trouble is developing in the truck, due to neglect, the inspection report can be accompanied by a letter giving detailed



Here is the service car used by the Autocar Co. of St. Louis. This truck is fitted out with many replacement units, such as axle shafts, fan assembly, gearset, water pump assembly, magnetos, bolts, shackles, etc. It also contains all the necessary equipment for towing, pulling out of the mud, etc.

HAMILTON MOTOR TRUCK SALES CO.
(Maintenance Division)

Name of truck.....

Purchaser's Name.....

Model

Address

Engine Number.....

Truck Used For.....

MONTHLY TRUCK INSPECTION REPORT

- 1—Is radiator full of water.....
- 2—Is anti-freeze required
- 3—Is fan belt tight.....
- 4—Are all water joints tight.....
- 5—Are hose connections good.....
- 6—What is general appearance of engine.....
- 7—Are engine holding down bolts tight.....
- 8—Are any engine or radiator bolts missing.....
- 9—Is engine compression good.....
Cylinder 1....., 2....., 3....., 4.....
- 10—Should carbon be cleaned out.....
- 11—Do valves need regrinding.....
- 12—Has engine normal power.....
- 13—Is there sufficient oil in crankcase.....
- 14—What is oil pressure, engine idling.....
- 15—Does governor operate properly.....
- 16—Does carbureter choke operate properly.....
- 17—Is carbureter adjusted correctly.....
- 18—Are fuel line screens clean.....
- 19—Are magneto points clean.....
- 20—Is magneto points gap correct.....
- 21—Are spark plug gaps set correctly.....
- 22—Is magneto distributor brush in good condition.....
- 23—Is clutch action smooth.....
- 24—Are universals in good condition.....
- 25—Are steering connections tight.....
- 26—Are wheel bearings tight.....
- 27—Is foot brake properly adjusted.....
- 28—Is hand brake properly adjusted.....
- 29—Is lining needed on either set of brakes.....
- 30—Are spring clips tight.....

- 31—Is torque arm tight.....
- 32—What is general condition of tires.....
- 33—Is rear axle noisy in operation.....
- 34—Do springs need lubrication.....
- 35—Are shackle bolts tight.....

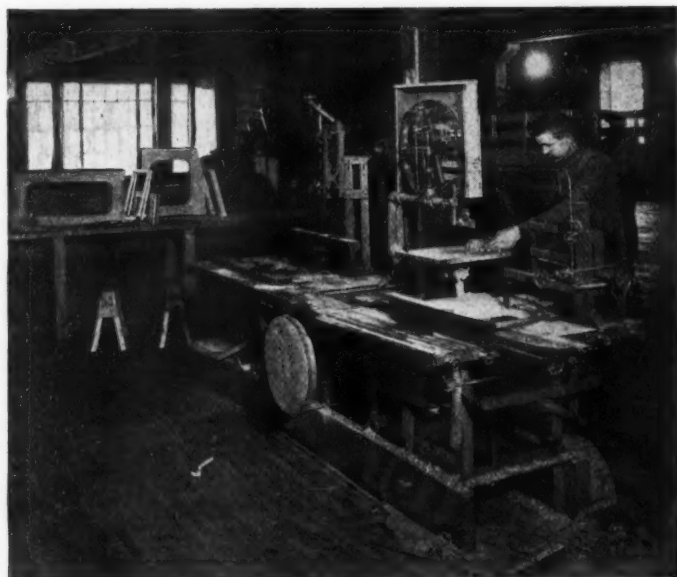
STARTING AND LIGHTING SYSTEM

- 36—Are commutators and brushes clean.....
- 37—What is voltage across generator brushes.....
- 38—Are connections well made.....
- 39—Has battery sufficient water.....
- 40—What is gravity of each cell—
Cell No. 1....., 2....., 3.....
- 41—Are lamp bulbs in good order.....
- 42—What is general condition of truck with regard
to cleanliness
- 43—Is truck operated intelligently.....
- 44—Is truck overloaded..... How much.....
- 45—Are there any matters requiring attention not
already covered
- 46—Name any points which show that proper
lubrication has been neglected

By.....
(Inspector)

Date.....

There have been many inspection sheets made up for use in truck maintenance, but we believe this to be one of the best. With a report of this kind an inspector who is skilled in his work can make an inspection in short order and have at the end of it a comprehensive analysis of the truck's condition. It is about as complete as should be made, because if it contained much more it would be almost impossible for a man to make an inspection unless the truck were torn down. This form is intended to be used with such inspections as are given when the truck is on the road and when the inspector can catch it at rest for a time. Usually a check mark back of the item is all that is required to show that this particular item is all right. Items 45 and 46 are useful because therein can be covered anything not mentioned in the preceding items



At first glance this might seem like the interior of a planing mill. It is not. It shows the woodworking establishment in a truck maintenance department of one organization. A woodworking department comes in handy for the building and repair of stake bodies and other bodies for trucks.

information as to how to prevent the recurrence of this trouble, when the inspection report is mailed to the owner.

The best plan in sending the inspection report is to mail it directly to the owner of the truck. By no means should the report be sent to the truck operator.

The truck inspector should also insist that so far as possible the truck operator should be present when the inspection is made. Thus the inspection can serve the dual purpose of being educational to the truck driver and at the same time check the mechanical condition of the truck.

The first inspection that a new truck receives is a very important one. If the inspector is on to his job he will be able to tell just how thorough the driver has been in his care of the truck. This information is of value to the dealer, also, because he will then be able to inform the owner of the truck that his driver is or is not up to the standard that he must employ to get maximum service out of the truck.

The inspector should be a competent man, familiar with all of the mechanical details of the truck. At the time of delivery of the truck he should accompany it, explaining to the driver the dangers resulting from overloading and over speeding a new truck. The driver must be coached in the proper handling of the engine until it has become well run in. Every truck has its own peculiarities and these should be imparted to the driver by the inspector.

Advantage of Regular Inspection

The advantage of regular inspection lies in the fact that trouble is reduced to a minimum, because anything serious which might develop is nipped in the bud. When making up the inspection sheet sufficient space should be left at the bottom to permit the inspector to make a statement regarding the lubrication which the truck has received, and also any suggestions that may be beneficial to the concern operating the truck. Note, for example, the observations which the inspector for the Federal Motor Truck Co. of St. Louis has made on the inspection sheet reproduced on these pages.

In regard to inspection sheets themselves, the best plan seems to be that of making two copies, one to be sent to the truck owner and the other to be filed in the maintenance department of the truck company. By keeping a copy in the office the maintenance department protects itself, so that if later on the truck breaks down, the owner can be shown that on such and such date his truck was inspected, but that this inspection was ignored.

Various means are used in covering the expense of these inspections. Some concerns charge for the labor and materials used, while others charge only for the materials, provided the truck is delivered to the maintenance department. Some have

worked out a definite schedule and have divided their territory into zones, the charge for the inspection increasing as the zones become farther away from the maintenance department. In the latter case the inspector's time, the material used and the transportation for the inspector must be considered. From the experience of the previous inspections, it would be possible to work out and adopt a standardized inspection charge for each zone.

Difference Between Truck and Car Maintenance

While there are several ways in which truck maintenance differs from passenger car maintenance, one stands out in particular. That is in the unit replacement idea. Many of the successful truck organizations are selling their maintenance on that basis. Some do it with certain units only. Others may have rebuilt engines which they place in a chassis until the engine which belongs to that chassis has been repaired and again installed, the customer being charged so much a day rental. This makes it possible for him to use the truck while the engine is in the shop.

The unit replacement idea lends itself well to springs. Thus when a truck comes in with a broken spring, it is taken out, a replacement spring installed and the truck goes on its way. The owner is charged only for the repair of the original spring, which when it has been repaired is installed in some other truck when occasion demands. The same can be done with other units.

One of the best plans to follow in truck maintenance is to get from the factory a sort of equipment card which tells exactly the make and type of clutch, gearset, universals, steering gear, magneto, etc., fitted to that particular truck. This is useful in this way:

When a truck driver calls up that he is stalled many miles out with a broken universal joint, the maintenance department can refer to the card for that truck and ascertain the make and model of joint to be sent out by the repair car. They have

DUPLICATE		RUSSELL P. TABER, INC.		DATE OF TRUCK INSPECTION	
TRUCK INSPECTION REPORT				DATE OF LAST INSPECTION	
Owner	Truck	Driver			
Street	Model	Capacity of Truck			
Town	Serial No.	Average Load			
License No.	Total Mileage	Road Conditions			
MOTOR		CLUTCH		TRANSMISSION	
Type	Full Chassis	Oil Level			
Valves	Ball Thrust	Adjustment			
Spark Plugs	Clutch & Trans. Shaft	Shifting			
Breaker Points	Shut Clutch Effort	Gear			
Overhaul	— — — — —	Log Book			
Log Book		Universal Joint			
Clutch System		Drive Shaft			
Fast Bolt					
Reflector					
How Connected					
REAR AXLE		RUNNING GEAR		STEERING	
Oil Level	Front Frame Cross Member	Front Wheel Alignment		Wear	
Pinion Bearings	Springs	Spring Ends & Shockers		Frame & 1st Rod	
Spring Clips	Spindle Bearings	All Cross Caps		Cross Rod	
Emergency Brake				Steering Arm	
Fast Bolt					
N. A. Alignment					
Time Hrs.		Waiting Time Hrs.		Signed	
REPORT OF SERVICE DEPT.—Advisory Board					
SIGNED RUSSELL P. TABER, INC.					

Another form of inspection report. This one groups the various units of the trucks and makes it very handy to immediately ascertain the condition of any one. Note also that the report contains information as to road conditions, mileage, etc.

FEDERAL TRUCK CO. OF ST. LOUIS
 Date Mar. 13, 1922 Inspector Don
 Owner Ben Longman
 Driver _____

Items marked (1) were inspected by me and found satisfactory
 Items marked (0) required attention and were adjusted
 Items marked (X) will require shop attention.

ENGINE	X	Steering Knuckles Right	/
Starting Crank Test	X	Steering Knuckles Left	/
Connecting Rods	X	Steering Arms	/
Main Bearings	X	Brakes—Service, Condition	/
Crank Bearings	X	Brakes—Emer., Condition	/
Wrist Pins	X	Truss Rod	/
Cam Gears	/	Radius Rod	<u>Bushings</u>
Push Rods	X	Clutch	/
Valves	X	Axle, Front	/
Valve Springs	/	Axle, Rear	<u>Pushed up</u>
Governor	X	Springs, Front	/
OILING SYSTEM	/	Springs, Rear	/
Leaking Crank Case	/	Cross Con. Tube	/
Leaking Transm. Case	/	Spring Hanger	/
COOLING SYSTEM	X	Sprockets	/
Radiator	/	Chains	/
Pump	X	Propeller Shaft	/
Connections	X	Wheel Bearings	/
Fan	/	Hubs	/
Fan Bearings	/	Oil Cups	X
Fan Belt	/	Grease Cups	X
CARBURETOR <u>Choke</u>	X	Shifting Rod Pins	/
GASOLINE Feed Pipe	/	Gear Shift	/
TIRE	/	Transmission	/
IGNITION SYSTEM	X	Universal Joints	<u>Rear</u>
Magneto	X	Spring Shackles	<u>Don't work</u>
Spark Plugs	/	Front Wheel	/
Wiring & Connections	/	Rear Wheel	/
Steering Gear	X	Frame	<u>Front</u>
Steering Arm	X	Truck Generally well taken care of?	/

Muffler needs repairing
Exhauster covers leak
Note done on rear spring
Cross tubes hand throttle
don't work
 Signed by Ed S. Dow

The Federal Truck Co. of St. Louis uses this sort of an inspection report, which, by the way, brings much business into the maintenance department. A different mark is used to check the various items, which then tells whether the job is one that must be handled in the shop, or can otherwise be attended to

to take the driver's word for nothing, as all the information is on the card. All that need be known is make and model number of the truck.

In making inspections of a truck, most companies have found it best to do this when the truck is in actual operation. Instead of the inspector being given a list of ten or twelve trucks to be inspected on a certain day, he is allowed to work on his own hook, so to speak. Thus he might start out early in the morning to catch a certain truck used by a commission house, while the truck is being loaded with produce. He can make most of his tests with the truck standing still and then when the time comes to drive it away, jump on the seat beside the operator.

Inspect Truck When in Operation

After he has finished with this truck he may spot another close by and he immediately carries out the same tactics on this one. If he worked to a plan whereby he took a chance on finding a certain truck at a certain address, that truck might be miles away at the time of his arrival. So the idea is to catch them as he can. This method has the additional advantage in that it usually catches the driver unawares and he has no time to doctor the governor or make any hasty adjustments.

Truck inspectors usually go about their work in a Ford

runabout or on a motorcycle. Naturally they must be amongst the best trained men the organization has, because it takes a good man to diagnose trouble which might be coming on in a truck.

While most motor car dealers close down their maintenance departments at night and on Sunday, the truck dealers find it practically impossible to do this. A passenger car might be allowed to rest by the roadside for a day or so and the occupants carried to town in another car, but with a truck loaded with a valuable cargo it becomes a matter of dollars and cents to the trucking concern, the receivers of the load and perhaps a half dozen others. It is important, then, to get aid to the truck as soon as possible.

For this reason a service car is kept ready in the maintenance department to go out at a moment's notice. In the better planned organizations this car is never allowed to be parked somewhere in the building with the contents of the gasoline tank almost empty. It is gone over the minute it gets back from a trip. The fuel tanks are filled and any parts which might have been removed for installation on a broken down truck are replaced. With the right sort of equipment on the service car, as to hoists, jacks, etc., usually one man is all that need go with it. There is generally the driver of the truck at the other end of the line to help him.

Method of Inspection

In some of the most successful truck maintenance stations, especially where the unit replacement idea is carried out, the plan of operation on a job of, say brake lining, is this:

The truck comes in and immediately two or three men get going on it to remove the brake bands. These men may be taken out of the shop where they have been busy going over the replacement units. They take out the old bands and put in a set of relined ones and the result is that the truck goes out of the station in comparatively short order, because the driver does not have to wait until the bands that were in his truck are relined. The old bands are relined whenever the men are not busy with something else and then are installed in some other truck.

This method of procedure has the advantage of keeping the men busy at all times and yet getting a customer out quickly by concentrating several men on a job.

Safety precautions are very necessary in truck maintenance buildings. The work is of a much heavier nature than that on passenger cars and steps must be taken to protect the men. For example, the job of getting a body off a 5-ton truck is vastly different from that of removing a passenger car body. Overhead hoists and carriers are very handy in the truck shop and eliminate much danger in handling bodies.

A broken crankcase resulting from the engine falling off a bench taught one truck maintenance company the necessity of engine stands in which to support the engines while being worked upon. When raising up a truck at the front or rear, the best plan is to place the heavy cast iron supports under the frame or axle and not merely depend upon a chain hoist. It is safer for men and truck alike.

CAST IRON CUTTING BY OXY-ACETYLENE FLAME

CAST IRON cutting by the oxy-acetylene flame is an interesting development of the last two years. The cast iron must be preheated to redness over a considerable space. A large and powerful oxygen jet is then directed on the red hot cast iron, with the preheating continued. The kerf made in the iron casting is quite similar to that made in cutting of steel, except that its width is generally double that in a similar sized steel casting and it is not quite so clean looking. It is plain that more gases are used than in similar steel cutting, and it has been noted in tests that the time for cutting is about double that in the case of steel; therefore, cast iron cutting is three or four times as costly as steel cutting and in normal work it can hardly be said to compete with saws.

The Manufacturers' Aircraft Association is attempting to compile a list of all the aviators in the country, together with a general scope of their activities. It is hoped to have every operator in the country fill out this questionnaire, a copy of which can be obtained by request to the association at 501 Fifth Avenue, New York City.

Keeping the Paint Shop Busy All Year

By Showing the Car Owner the Functions of the Different Paint Coats He Will Readily See the Economy of Having Certain Work Done Before Total Deterioration Takes Place

By G. KING FRANKLIN

THE paint shop can be profitably operated twelve months out of the year. The demand for painting fluctuates according to the season, but this only means that at slack times the effort to sell it should be speeded up. The demand for any article or service is a variable wholly dependent upon need, individual ability and effort. Demand itself may be defined as a "pressing need." From all of which it can be seen that to create a demand for anything it is only necessary to show a real need for that thing, and the way in which the need is shown will determine the extent of the demand, and this in turn will determine the volume of sales.

Now, it is evident to all that the only reason for off-seasons in the service field is the fact that there are bad driving seasons of the year when the car owners are willing to lay up their cars for tuning or dolling up, while during the seasons of good roads and weather few of them can bear the thought of parting with their cars for even a day.

Faulty motors shriekingly cry for help or simply balk—and get attention. But faulty paint coats suffer silently. Few owners are competent to judge the condition of smooth finishes and high luster—as shown in the December 15th issue of MOTOR AGE. And hence it becomes evident that they must be told something about the materials and operations used, so that the need for immediate service can be more easily shown.

Knowledge Not Necessary to Sale

Painting an automobile is not like painting a house,—that is awaiting the lifelessness of the old work and then coating over it with fresh material. A paint job on a car means quite a number of surfacing and decorating costs, but only one that is protective, and knowledge of that is just what is needed to sell a revarnishing job to a man whose car is in such shape

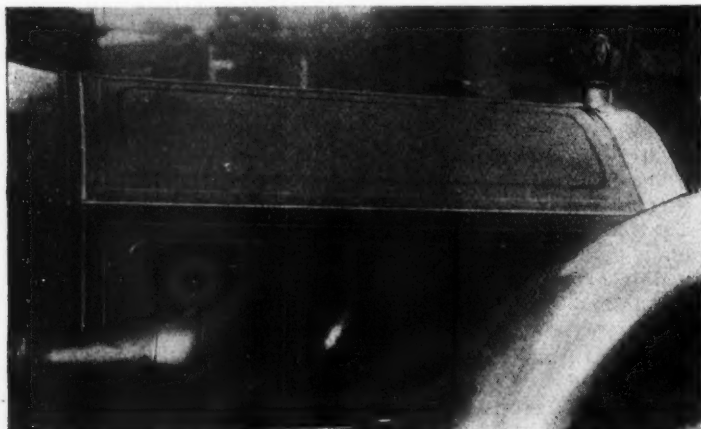


Fig. 2—An example of a surface in good condition but which has lost its lustre. A coat finishing varnish will restore the lustre and protect the under coats now subjected to exposure

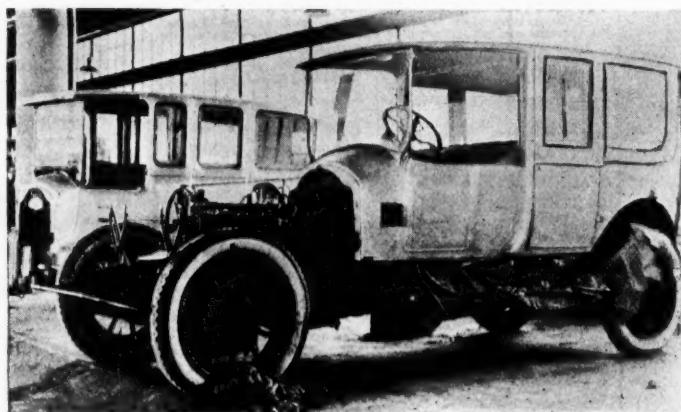


Fig. 1—Dismantling necessary to correctly perform a burn-off and repaint job. Photographs by courtesy of the Chicago College of Auto Painting

that its surfaces can be adequately revived with a coat of finishing varnish—the only protective coat.

Knowledge of the craft is not necessary to sell this kind of service. But knowledge of the theory of the work is very necessary, and any salesman who possesses it can successfully sell paint service at any time of the year. A job that might only need revarnishing in June or July might have to be burned off and repainted a few months later. A couple of days' time and little expense against a month's time and big expense if let go.

The difference between these two styles of work is well shown in Figs. 1 and 2. Fig. 2 shows a close-up view of a surface that is in good condition but the finishing varnish has lost its luster and is wearing off. It can be adequately revived by applying a coat of finishing varnish which will restore the luster and protect the undercoats that are now being subjected to exposure.

If let go for any great length of time these paint coats will dry out hard and brittle or start to crack and when this condition reaches the metal they are no longer fit for refinishing if good work is to be done.

The surfaces should be protected with finishing varnish at once. And this is one instance of work that can be had even in the summer if the truth of the condition is properly brought home to the car owner.

If neglected until winter it may mean a burn off and repaint job and the difference between that and a revarnish is aptly shown by Fig. 1. This shows a car that has had all of the old paint coats removed from the body, and the amount of labor involved can be seen when it is known how much stripping has been done, and when it is realized that some ten or eleven coats of materials will be used in bringing it back to its former good condition, and about a month's time taken for the work.

Paint Service Needed

If the condition of the surfaces is worse than shown in Fig. 2 where a simple revarnishing is required, then perhaps a color varnish job would suffice, or if still worse a repaint job. But in any case, with good undercoats, there is no reason why a paint job should be allowed to go so long that all of the old work has to be burned off and new coats applied. The work should be done when needed and not at such times as will cause the owner the least inconvenience.

During the summer months it is practical to plan a sales campaign and solicit just such jobs as can be turned out in the least possible time. If an owner has a car that requires burning off there is, of course, no reason why that cannot

wait until the end of the driving season. But to save an owner time and money in this sort of work is to do him a real service and that counts.

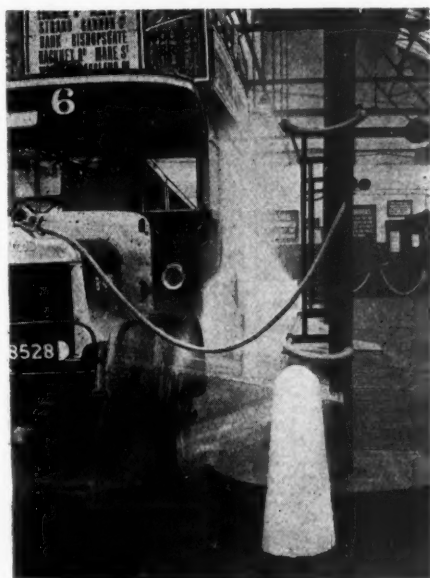
The need for adequate service on paint and varnish is becoming daily more noticeable. Some dealers see the handwriting on the wall and are beginning to lay the foundation for such a department in their business. Others, convinced of the need, are postponing the step until forced to take it. There is no doubt but that this time is at hand now, and that

painting has become a very necessary and important branch of the service field.

To those interested in acquiring a knowledge of the subject or in obtaining instruction for some employe, we can repeat what we have before stated, viz: that the Chicago College of Auto Painting is doing very creditable work in teaching how the work is done, by home study instruction, and no one can say that he does not undertake the work because he is unable to learn the "know how."

Washing Motor Vehicles by Machinery

THE washing of cars, whether it be done in the small or large service station, presents certain problems. Especially is this true where the number of cars to be washed daily runs quite heavy. Automatic appliances, as in many other instances of service work, have demonstrated their usefulness in car washing, and in this connection it is interesting to observe how 75 per cent of the cost over the old, and often in different, way of cleaning by hand, has been saved in the maintenance division of the London General Omnibus Co. With the aid of two men, busses are disposed of at the rate of one every two minutes.



In this view the washing installation is shown while cleaning one of the busses. The radiator is being filled with water at the same time. No labor is required

As the busses come in they are first dusted off with brooms. Then they are run between two ranges of four fixed angle-iron standards four ft. apart with a space of 12 ft. 10 in. between the rows. At two points these standards are connected with rails. On each range of standards are two one-inch brass sprinkler pipes which are worked by levers.

When the levers are pulled down, the water is automatically sprayed onto the bus, and when the lever is released the supply is automatically shut off. This is permitted by means of a plug valve and counterweights.

In addition to this, one range of standards carries arms through which a one in. brass sprinkler pipe is fixed. This is automatically lowered for washing off the tops of the busses, including tickets and other refuse.

When released, this sparge pipe, as it is called, flies back to its original position and in so doing shuts off the water. The connections between the fixed pipes and the movable parts are made with armored rubber hose. All but the sparge pipes are of welded iron. The main supply to each machine is two in. and to the branches one and one-quarter in. The most efficient pressure consistent with economy is 50 lb. per sq. in.

In addition to the washing connection, a rubber hose branch pipe is installed to supply water for filling the bus radiators before they are sent on their way, for window wiping, etc.

At the foot of each range is a raised concrete and paved platform 24 ft. long, 5 ft. wide and 6 in. high on either side with 7 ft. space between. The edges of this platform are protected by a 6-in. steel rig, fixed by lugs 3 ft. 6 in. apart.

Along the center of each platform a hollow channel 18 in. wide is formed to contain water for the washers to dip their brushes into when the sprays fail to break up an exceptionally obstinate

cake of mud. These channels are kept filled by the drainage from the pipes when they fall back into position. A waste is provided from each channel for emptying and cleaning purposes.

In addition to these channels, there is another smaller sinking in the paving at the front of the machine. The water collecting in this is used for washing the front axles.

The center space between the platforms has a rectangular pit 10 ft. by 5 ft. by 4 ft. 6 in. deep with 12-in. thick concrete walls and a 6-in. concrete bottom, this pit serving to take sludge and waste water. The solid matter which accumulates at the bottom of the pit is periodically cleared out.

In this process use is made of vacuum cleaning outfits which are moved from one inspection shed to another instead of continuing to employ two men per shed for this purpose.

A 4-in. drain outlet near the top of the pit takes away the surplus water into the main drains on the premises. This pit is partially roofed over with concrete, having a 7-ft. by 2 ft. opening which is covered with a triple-section movable grating of cast iron.

The water supply from the main, and also each branch service, is controlled by a stop cock.



The installation by means of which the London General Omnibus Co. cleans its busses with a water spray which saves 75 per cent of the cost of the old method of cleaning these busses by hand. Note the arrangement of runways for the busses and the neatness and cleanliness of the whole installation as well as the excellent lighting facilities

BRAKE LINING SIZES

from 1912 to 1922

Motor Age Maintenance Data No. 171

This Data is Published from Year to Year. The Information is Supplied by the Manufacturers

1912 Models

CAR AND MODEL	EXTERNAL			INTERNAL			CAR AND MODEL	EXTERNAL			INTERNAL			CAR AND MODEL	EXTERNAL			INTERNAL		
	Length	Width	Thick-ness	Length	Width	Thick-ness		Length	Width	Thick-ness	Length	Width	Thick-ness		Length	Width	Thick-ness	Length	Width	Thick-ness
Cadillac—All.	54	2½	¾	51	2½	¾	Hupmobile—C.	40	2	¾	13	1	¾	Packard—1-48.	46½	2½	¾	No lining		
Case—M.	43½	2½	¾	39¾	2½	¾	Inter-State—40.	40	2	¾	38	2	¾	Paige—25.	28½	1½	¾	29¾	1½	¾
Crawford—All.	41	2	¾	41	2	¾	Kissel Kar—All.	34½	4	¾	38	3½	¾	Peerless—All.	44	2½	¾	10½	3	¾
Cunningham—J.	44	2½	¾	39¾	2½	¾	Lenox—All.	13	1¾	¾	13	1¾	¾	Pierce-Arrow—6-66.	18¾	3¼	¾	16¾	3	¾
Dorris—G.	43½	2½	¾	40	2½	¾	Locomobile—All.	21½	3	¾	14½	2	¾	Pierce-Arrow—6-48.	18¾	3¼	¾	16¾	3	¾
Empire—25.	27½	1¾	¾	29½	1¾	¾	Lyons-Knight—K.	49¼	2½	¾	47¼	2½	¾	Pierce-Arrow—6-36-38.	15¼	3	¾	13¾	2¾	¾
Ford—T.	23½	1½	¾	No lining			McFarlan—All.	43	1½	¾	43	1½	¾	Reo—R & S.	43	2	¾	38¼	2	¾
*Franklin—G 1 & 2.	30	2	¾				McFarlan—All.	41½	1½	¾	41½	1½	¾	Stearns—SK 4 & 6.	24	2¼	¾	17¾	2¼	¾
*Franklin—G 1 & 2.	19	3	¾				Merced—All.	9½	3¾	¾	14	2	¾	Studebaker—A.	35½	2	¾			
*Franklin—M1, M2 & G2.	35½	2½	¾				National—All.	43½	2½	¾	41½	2	¾	Studebaker—S.	26½	2	¾			
*Franklin—M1, M2 & G2.	23½	4	¾				Oakland—40.	30½	1½	¾	30½	1½	¾	*Stutz—A.				14½	1¾	¾
*Franklin—H1, H2 & D2.	44½	3	¾				Oldsmobile.	48	2½	¾	47	2½	¾	*Stutz—A.				14½	1¾	¾
Glide—36-42.	41	2	¾	41	2	¾	Overland—58 & 59.	26½	2	¾	28	2	¾	Velie—R.	40¾	1½	¾	39¾	1½	¾
Haynes—21 & 22.	43½	2½	¾	41¼	2½	¾	Overland—60.	33½	2	¾	53½	2	¾	Velie—O.	43½	2½	¾	39¾	2½	¾
Hudson—33.	35½	1½	¾	35½	1½	¾	Overland—61.	40	2½	¾	42	2½	¾	Westcott—All.	33	2¼	¾	32	2¼	¾
							Packard—18 & 30.	12½	2½	¾	No lining			Winton—17C.	44¼	3	¾	42½	2½	¾

*Transmission brake

†Both brakes internal.

1913 Models

CAR AND MODEL	EXTERNAL			INTERNAL			CAR AND MODEL	EXTERNAL			INTERNAL			CAR AND MODEL	EXTERNAL			INTERNAL		
	Length	Width	Thick-ness	Length	Width	Thick-ness		Length	Width	Thick-ness	Length	Width	Thick-ness		Length	Width	Thick-ness	Length	Width	Thick-ness
Austin—77.	45	2½	¾	45	2½	¾	Hupmobile—H.	36½	2	¾	31½	2	¾	National—All.	43½	2½	¾	41½	2	¾
Cadillac.	54	2½	¾	51	2½	¾	Inter-State—50.	40	2½	¾	44	2½	¾	Oakland—42.	16¼	1½	¾	16¼	1½	¾
†Cartercar—S.	42¾	1½	¾	41¼	1½	¾	Jeffery—93.	41¾	1¾	¾	41¾	1¾	¾	Oakland—35.	35½	1½	¾	35	1½	¾
Case—O.	48¾	2½	¾	45¾	2½	¾	Jeffery—93.	27½	1¾	¾	27½	1¾	¾	Overland—All.	41	2½	¾	10½	2¼	¾
†Case—N.	48¾	2½	¾	40¾	1½	¾	Jeffery—104.	41¾	2	¾	41¾	2	¾	Packard—2-48.	43	2½	¾	No lining		
†Chandler—All.	41	2	¾	15	1¾	¾	Jeffery—104.	28½	1¾	¾	28½	1¾	¾	Paige—4-36.	40	2	¾	42¾	1¾	¾
Crawford—All.	41	2	¾	41	2	¾	King—B.	42¼	2	¾	19	2	¾	Paige—25.	28½	1½	¾	29¾	1½	¾
Cunningham—M.	53½	2½	¾	49	2½	¾	King—B.	42¼	2	¾	38½	2	¾	Peerless—All.	44	2½	¾			
Dorris—H.	43½	2½	¾	40	2½	¾	Kissel Kar—All.	34¾	4	¾	38	3½	¾	Pierce-Arrow—6-66.	18¾	3¼	¾	16¾	3	¾
E-M-F—6-35.	36½	1½	¾	36½	1½	¾	Klinekar—All.	101	2	¾	75	2½	¾	Pierce-Arrow—6-48.	18¾	3¼	¾	16¾	3	¾
Empire—31.	36½	2	¾	36½	1¾	¾	Lenox—All.	78	2	¾	78	2	¾	Pierce-Arrow—6-36-38.	15¼	3	¾	13¾	2¾	¾
Fiat—All.	22	2¼	¾	20	2	¾	Lexington—All.	48	2½	¾				Reo—R & S.	43	2	¾	38¼	2	¾
*Ford—T.	23½	1½	¾	No lining			Locomobile—All.	21½	3	¾	14½	2	¾	Speedwell—G H.	53½	2½	¾	49	2½	¾
*Franklin—M-3.	35½	2½	¾				†Lozier—27.	46½	2	¾	34½	2	¾	Stearns—SK 4 & 6.	24	2¼	¾	17¾	2¼	¾
*Franklin—M-3.	23½	4	¾				†Lozier—22 & 22A.	43¼	2½	¾	40¾	2	¾	Studebaker—SA.	29½	1½	¾			
*Franklin—D3-H3.	44½	3	¾				†Lyons-Knight—K.	49¼	2½	¾	47¼	2½	¾	Studebaker—AA.	33½	1¾	¾			
*Franklin—D3-H3.	28½	4	¾				†McFarlan—All.	43	1½	¾	43	1½	¾	*Stutz—B.				16½	1¾	¾
Glide—All.	15½	1¾	¾	15½	1¾	¾	†McFarlan—All.	41½	1½	¾	41½	1½	¾	*Stutz—B.				16½	1¾	¾
Haynes—23 & 25.	49	2¼	¾	48	2	¾	Merced—All.	9½	3¾	¾	19	2	¾	Velie—All.	43½	2½	¾	39¾	2½	¾
Haynes—24.	44	2¼	¾	42	2	¾	Metz—All.				24	1	¾	Westcott—All.	33	2½	¾	32	2¼	¾
Hudson—54.	50¾	2½	¾	48½	1½	¾	Moon—39-48.				40	2	¾	Winton—17D.	44¼	3	¾	42½	2½	¾
Hudson—37.	41¾	1½	¾	41¾	1½	¾														

*Transmission brake.

†Both brakes internal.

1914 Models

Austin—77.	45	2½	¼	45	2½	¼	†Haynes—28.				17½	2	¾	Oakland—48.	42½	1½	¾	40½	1½	¾
Briscoe—B-15.	24	1¼	¾	35	1¼	¾	†Haynes—28.				12	2	¾	Oldsmobile—54.	49	2½	¾	46½	1½	¾
Buick—B-24, 25, 36, 37,							Hudson—54.	50½	2½	¾	48½	1½	¾	Overland—79.	41	2¼	¾	109½	2¼	¾
54, 55.	40	2½	¾	46½	1½	¾	Hudson—6-40.	44½	2½	¾	42½	1½	¾	Overland—65.	41	2¼	¾	13¼	2½	¾
Cadillac.	54	2½	¾	51	2½	¾	Hupmobile—HA.	36½	2	¾	31½	2	¾	Packard—1-38.	43	2½	¾	No lining		
Cartercar—5.	42¾	1½	¾	41¼	1½	¾	Interstate—45.	39	2	¾	37	2	¾	Packard—3-48.	29½	2½	¾	No lining		
Chadwick.	44	2	¾	42	2	¾	Jackson—33.	45½	2	¾	42¾	1¾	¾	Packard—2-38.	52	2½	¾	No lining		
Chadwick—19.	44	2½	¾	42	2	¾	*Jeffery—All.	40¼	2	¾			Packard—4-48.	53½	2½	¾	47½	2½	¾	
Case—S.	42½	1½	¾	40½	1½	¾	*Jeffery—All.	20½	2½	¾			Paige—4-36.	45½	2	¾	42¾	1¾	¾	
Case—R.	37¼	1½	¾	35½	1½	¾	King—B.	41	2	¾	38½	2	¾	Pathfinder.	46½	2	¾	34¼	2	¾
Case—O.	48¾	2½	¾	45¾	2½	¾	Kissel Kar—All.	34¾	4	¾	38	3½	¾	Pathfinder—6-cyl.	46½	2¼	¾	34¼	2¼	¾
Chalmers—24.	60¼	2½	¾	48¼	1½	¾	Klinekar—All.	101	2	¾	75	2¼	¾	Peerless.	44	2¼	¾			
Chalmers—26-A.	43½	2½	¾	41¼	1½	¾	Krit—L & M.	33	2	¾	30	1½	¾	Pierce-Arrow—6-66.	20½	3¼	¾	19	3	¾
Chandler—All.				15	1½	¾	Lenox—All.	78	2	¾	78	2	¾	Pierce-Arrow—6-48.	18¾	3¼	¾	16¾	3	¾
Crawford—All.	41	2	¾	41	2	¾	Lexington—4-H.				15½	1¾	¾	Pierce-Arrow—6-36-38.	15¼	3	¾	13¾	2¾	¾
Cunningham—R.	53½	2½	¾	49	2½	¾	Locomobile—All.	44½	3	¾	14½	2	¾	Premier—A.	43½	2½	¾	14½	2¾	¾
Davis—6-50.	49	2½	¾	48	1½	¾	Lozier—30, 32 & 34.	53½	2½	¾	49	2½	¾	Regal.	31½	2	¾	29¼	1¾	¾
Davis—35J, 35K.	37¼	1½	¾	35½	1½	¾	Lyons-Knight—K.	49¼	2½	¾	49	2½	¾	Reo—R & S.	43	2	¾	38¼	2	¾
Dodge—All.	42¾	2¼	¾	34½	2	¾	Marmon—41.	53½	2½	¾	49	2½	¾	Stanley—710.	32½	1¾	¾	35½	1¾	¾
Dorris—I.	43½	2½	¾	40	2½	¾	Maxwell—25.	34¾	1½	¾	17½	1½	¾	Stearns—SK 4 & 6.	24	2¼	¾	17¾	2¼	¾
E-M-F—All.	36½	1½	¾	36½	1½	¾	McFarlan—All.	51	2½	¾	48	1½	¾	Stevens-Duryea—D-6.				14	2¼	¾
Empire—33.	37	2	¾	36	1½	¾	Merced—All.	9½	3¾	¾	19	2	¾	Studebaker—All.	36½	2	¾			
Fiat—All.	22	2¼	¾	20	2	¾	Metz.				24	1½	¾	†Stutz—E.				16½	1¾	¾
*Ford—T.	23½	1½	¾	No lining			Mitchell—A.	51½	2¼	¾	47½	2	¾	†Stutz—E.				16½	1¾	¾
Franklin—Series 5.	35½	2½	¾				Moline-Knight—B.	52	2½	¾	52	1½	¾	Velie—9 & 10.	43½	2½	¾	39¾	2½	¾
Franklin—Series 5.	23½	4	¾				Moon—6-50.				40	2	¾	Velie—11.	42½	1½	¾	40½	1½	¾
Glide—All.	40½	2	¾				National—All.	50¼	2	¾	48¼	1½	¾	Westcott—O-30.	33	2¼	¾			
Glide—All.	15½	2	¾				Oakland—36.	37¼	1½	¾	35	1½	¾	Winton—20.	44¼	3	¾	42½	2½	¾
Haynes—26 & 27.	50	2½	¾	48	2½	¾														

*Transmission brake.

†Both brakes internal.

BRAKE LINING SIZES FROM 1912 TO 1922

1915 Models

CAR AND MODEL	EXTERNAL			INTERNAL			CAR AND MODEL	EXTERNAL			INTERNAL			CAR AND MODEL	EXTERNAL			INTERNAL		
	Length	Width	Thickness	Length	Width	Thickness		Length	Width	Thickness	Length	Width	Thickness		Length	Width	Thickness	Length	Width	Thickness
Allen-34	35 1/2	2	3/8	36 1/2	1 1/2	3/8	†Haynes-32	17 1/2	2	3/8	Overland-80	41	2 1/4	3/8	10 1/2	2 1/4	3/8			
Alter-4-27	28 1/2	1 1/2	3/8	27 1/2	1 1/2	3/8	†Haynes-32	12	2	3/8	Overland-81	30 3/4	2 1/4	3/8	9 1/2	2 1/4	3/8			
Apperson-All	40	2 1/4	3/8	36 1/2	2	3/8	Hollier-All	37 1/2	1 1/2	3/8	Overland-82	44 1/2	2 1/4	3/8	13	2 1/4	3/8			
Auburn-4-36	42 1/2	1 1/2	3/8				Hudson-6-40	44 1/2	2	3/8	Owen Magnetic-O-36	20 3/4	2 1/2	3/8	20 3/4	1 1/2	3/8			
Auburn-6-40	40	1 1/2	3/8				Hudson-54	50 3/4	2 1/2	3/8	Packard-All	53 1/2	2 1/2	3/8	47 1/2	2 1/2	3/8			
Austin-66	42	3	3/4				Hupmobile-K	41 1/2	2	3/8	Paige-6-36	37 1/2	2	3/8	35 1/4	2	3/8			
†Biddle-C				42	3	3/4	Inter-State-T	37	2	3/8	Pathfinder-6-cyl.	45 1/2	2 1/2	3/8	42 3/4	1 1/2	3/8			
Biddle-D				42	3	3/4	Jackson-44 & 46	45 1/2	2	3/8	Peerless-48-6	44 1/2	2 1/2	3/8	34 1/4	2 1/2	3/8			
Briggs-Detroit	34 1/2	1 1/2	3/8	23 1/2	1 1/2	3/8	*Jeffery-All	40 1/2	2 1/2	3/8	Peerless-54-56	43 1/2	2	3/8	38 3/4	2	3/8			
Briscoe-B-15	24	1 1/4	3/8	35	1 1/2	3/8	King-C & D	41	2	3/8	Pierce-Arrow-6-66	20 1/2	3/4	3/8	19	3	3/8			
Buick-C-24, C-25	35 1/2	1 1/2	3/8	37 1/2	1 1/2	3/8	Kissel Kar-All	88 1/2	2	3/8	Pierce-Arrow-6-48	18 1/2	3/4	3/8	16 1/2	3	3/8			
Buick-C-36, 37, 54	38 1/2	1 1/2	3/8	35	1 1/2	3/8	Klinekar-All	101	2	3/8	Pierce-Arrow-6-36-38	15 1/2	3	3/8	13 1/2	2 1/2	3/8			
Cadillac-51	54	2 1/2	3/8	51	2 1/2	3/8	Krit-L & M	33	2	3/8	Premier-6-50	49 1/2	2 1/2	3/8	44 3/4	2 1/2	3/8			
Case-R	40 1/2	1 1/2	3/8	40 1/2	1 1/2	3/8	Lenox-All	78	2	3/8	Pullman	31 1/2	1 1/2	3/8	27 1/4	1 1/2	3/8			
Chadwick-19	44	2 1/2	3/8	42	2	3/8	Lexington-6-L				R. C. H.	32 1/2	1	3/8	29 1/2	1	3/8			
Chalmers-26-B	43 1/2	2 1/2	3/8	41 1/4	1 1/2	3/8	Locomobile-All	48 1/2	3	3/8	Regal	31 1/2	1	3/8	28 1/2	1	3/8			
Chalmers-29	50 1/2	2 1/2	3/8	48 1/4	1 1/2	3/8	Lozier-30, 32 & 34	53 1/2	2 1/2	3/8	Reo-R & S	43	2	3/8	38 3/4	2	3/8			
Chalmers-32-A	37 1/2	2 1/2	3/8	34 1/4	1 1/2	3/8	Marmon-41	53 1/2	2 1/2	3/8	Reo-M	43	2 1/2	3/8	38 3/4	2	3/8			
Chandler-16B	27 1/2	1 1/2	3/8	15	1 1/2	3/8	Maxwell-25	34 1/2	1 1/2	3/8	Saxon-A	21 1/2	1 1/2	3/8	21 1/2	1 1/2	3/8			
Chevrolet-490	35 1/2	1 1/2	3/8	35	1 1/2	3/8	McFarlan-All	51	2 1/2	3/8	Saxon-S & S2	30 1/2	1 1/2	3/8	12	1 1/2	3/8			
Chevrolet-H-4	41	2	3/8	41	2	3/8	†Mercer-All				Scripps-Booth-C	27 1/2	1 1/2	3/8	27 1/2	1 1/2	3/8			
Crawford-6-35	53 1/2	2 1/2	3/8	49	2 1/2	3/8	†Mercer-All				Singer-15	48 1/2	2 1/2	3/8	47 1/2	2 1/2	3/8			
Cunningham-S	37 1/4	1 1/2	3/8	35 1/2	1 1/2	3/8	Metz	18	1	3/8	Stanley-720	32 1/2	1 1/2	3/8	35 1/2	1 1/2	3/8			
Davis-38, A, B & C	37 1/4	1 1/2	3/8	20	1 1/2	3/8	Mitchell-B	44	2 1/2	3/8	Sterna-SKL-4	25	3	3/4	80	1 1/2	3/8			
Dispatch	42 1/2	2 1/2	3/8	34 1/2	1 1/2	3/8	Moline-Knight-B	32	2 1/2	3/8	Stevens-Duryea-D-6				14	2 1/4	3/8			
Dodge-All	43 1/2	2 1/2	3/8	40	2 1/2	3/8	Moline-Knight-E	42 1/2	2	3/8	Studebaker-EC	34 1/2	2 1/2	3/8	16 1/2	1 1/2	3/8			
Dorris-5	27 1/2	1 1/2	3/8	28 1/2	1 1/2	3/8	Monroe-M	27 1/2	1 1/2	3/8	Studebaker-SD & 5	34 1/2	2 1/2	3/8	12 1/2	1 1/2	3/8			
Empire-40	37	2	3/8	36	1 1/2	3/8	Monitor-All	34	1 1/2	3/8	Studebaker-SD & EC	42 1/2	2 1/2	3/8	12	1 1/2	3/8			
Fiat-55 & 56	22	2 1/2	3/8	20	2	3/4	Moore-6-40				†Stutz-F				16 1/2	1 1/2	3/8			
*Ford-T	23 1/2	1 1/2	3/8	No lining			Moore-6-50				†Stutz-F				18 1/2	1 1/2	3/8			
*Franklin-All	35 1/2	2 1/2	3/8				National-All	50 1/4	2 1/2	3/8	Valie-15	40 1/2	2	3/8	40 1/2	2	3/8			
*Franklin-All	24	4	3/8				Oakland-37	37 1/4	1 1/2	3/8	Valie-22	34 1/4	2	3/8	31 1/2	1 1/2	3/8			
Glide	40 1/2	2	3/8				Oakland-49	48 1/2	1 1/2	3/8	Westcott-U-50	42 1/2	1 1/2	3/8	41	1 1/2	3/8			
Glide	15 1/2	2	3/8				Oldsmobile-55	49	2 1/2	3/8	Winton-21	44 1/4	2 1/2	3/8	42 1/2	2 1/2	3/8			
Grant-T	34	1 1/2	3/8	31	1 1/2	3/8	Oldsmobile-42	37 1/4	1 1/2	3/8	Winton-21-A	44	2 1/2	3/8	40	2 1/2	3/8			
Haynes-30	50	2 1/2	3/8	15 1/2	1 1/2	3/8														
Haynes-31	50	2 1/2	3/8	48	2 1/2	3/8														

* Transmission Brake. † Both brakes internal.

1916 Models

Abbott-Detroit-8-80	54	2 1/4	3/8	50	2 1/4	3/8	*Franklin-All	35 1/2	2 1/2	3/8	-----	-----	Oakland-50	43 1/2	1 1/2	3/8	40 1/2	1 1/2	3/8	
Abbott-Detroit-6-44	36	1 1/2	3/8	36	1 1/2	3/8	*Franklin-All	24	4	3/8	-----	-----	Oldsmobile-43	35 1/2	1 1/2	3/8	34 1/2	1 1/2	3/8	
Allen-All	34 1/2	2	3/8	34 1/2	1 1/2	3/8	Glide-6-40	41	2	3/8	40 1/2	2	3/8	Oldsmobile-44	38 1/2	1 1/2	3/8	35	1 1/2	3/8
Alter-C	28 1/2	1 1/2	3/8	27 1/2	1 1/2	3/8	Grant-V	34	1 1/2	3/8	41	2	3/8	Overland-75	38	1 1/2	3/8	12 1/2	1 1/2	3/8
Apperson-All	40	2 1/4	3/8	36 1/2	2	3/8	Hal-21 & 22	48 1/4	2 1/2	3/8	44 1/2	2 1/2	3/8	Overland-83	41	2 1/2	3/8	10 1/2	2 1/2	3/8
Argo-All	23 1/2	1 1/2	3/8	16	1	3/8	Haynes-34 & 35	-----	-----	-----	15 1/2	1 1/2	3/8	Overland-84 & 86	44 1/2	2 1/2	3/8	13	2 1/2	3/8
Auburn-6-38	42 1/2	2	3/8	-----	-----	-----	Hollier-All	37 1/2	2	3/8	34 1/2	1 1/2	3/8	Owen Magnetic-O-36	20 3/4	2 1/2	3/8	-----	-----	-----
Auburn-6-40A	49	1 1/2	3/8	-----	-----	-----	Hudson-6-40	44 1/2	2	3/8	40 1/2	2	3/8	Owen Magnetic-M-25	48 1/4	2 1/2	3/8	44 3/4	2 1/2	3/8
Austin-66	42	3	3/4	42	3	3/4	Hupmobile-N	41 1/2	2	3/8	39 1/2	2	3/8	Packard-All	53 1/2	2 1/2	3/8	47 1/2	2	3/8
Bell-A-16	28	2	3/8	24	1 1/4	3/8	Inter-State-T	37	1 1/2	3/8	36	1 1/2	3/8	Paige-6-38	38 1/2	2	3/8	35 1/4	2	3/8
†Biddle-D	-----	-----	-----	42	2	3/8	Jackson-34 (1st 500)	37 1/2	2	3/8	35 1/2	2	3/8	Paige-6-46	44	2	3/8	42	2	3/8
Biddle-D	-----	-----	-----	29	1 3/4	3/8	Jackson-34B (Bal.)	38 1/2	2	3/8	35 1/2	2	3/8	Peerless-56	43 1/2	2 1/2	3/8	38 3/4	2	3/8
Briggs-Detroit	34 1/2	1 1/2	3/8	23 1/2	1 1/2	3/8	Jackson-68	44	2	3/8	42	2 1/2	3/8	Pierce-Arrow-6-66	20 1/2	3/4	3/8	19	3	3/8
Briscoe-All	30	1 1/2	3/8	31 1/2	1 1/2	3/8	Jones-All	37 1/4	2	3/8	35 1/2	1 1/2	3/8	Pierce-Arrow-6-48	18 1/2	3/4	3/8	16 1/2	3	3/8
Buick-D-54, 55	49 1/2	2 1/2	3/8	46 1/2	1 1/2	3/8	King-E	41	2	3/8	38 1/2	2	3/8	Pierce-Arrow-6-36-38	15 1/2	3	3/8	43 3/4	2 1/2	3/8
Cadillac-53	54	2 1/2	3/8	51	2 1/2	3/8	Kissel Kar-All	88 1/2	2	3/8	18 1/2	2	3/8	Pilot-6-45	34	2 1/2	3/8	34	1 1/2	3/8
Case-T	40 1/2	1 1/2	3/8	40 1/2	1 1/2	3/8	Klinekar-All	67	1 1/2	3/8	67	1 1/2	3/8	Premier-6-51	49 1/2	2 1/2	3/8	44 3/4	2 1/2	3/8
Chadwick-19	44	2 1/2	3/8	42	2	3/8	Lenox-All	78	2 1/2	3/8	84	2 1/2	3/8	Pullman	31 1/2	1 1/2	3/8	27 1/4	1 1/2	3/8
Chadwick-21	44	2 1/2	3/8	42	2	3/8	Lexington-6-O	35	2	3/8	33	1 1/2	3/8	Reo-R & S	43	2	3/8	38 3/4	2	3/8
Chalmers-26-C & 32-B	43 1/2	2 1/2	3/8	41 1/4	1 1/2	3/8	Lexington-6-N	-----	-----	-----	15 1/2	1 1/2	3/8	Reo-M-N & F	43	2 1/2	3/8	38 3/4	2	3/8
Chalmers-35-A	37 1/2	1 1/2	3/8	35 1/4	1 1/2	3/8	Liberty-10-A	37	1 1/2	3/8	23 1/2	2 1/2	3/8	Saxon-S & S2	30 1/2	1 1/2	3/8	12	1 1/2	3/8
Chandler-All	45 1/2	2	3/8	43	1 1/2	3/8	Locomobile-All	48 1/2	3	3/8	40	2 1/2	3/8	Scripps-Booth-C	27 1/2	1 1/2	3/8	27 1/2	1 1/2	3/8
Chevrolet-490	27 1/2	1 1/2	3/8	26 1/2	1 1/2	3/8	Lozier-30, 32 & 34	53 1/2	2 1/2	3/8	40	2 1/2	3/8	Singer-16	48 1/2	2 1/2	3/8	47 1/2	2 1/2	3/8
Chevrolet-H-4	35 1/2	1 1/2	3/8	35	1 1/2	3/8	Marmon-34	53 1/2	2 1/2	3/8	47 1/2	1 1/2	3/8	Stanley-725	32 1/2	1 1/2	3/8	35 1/2	1 1/2	3/8
Cole-860	45	2	3/8	43 1/2	1 1/2	3/8	Maxwell-25	34 1/2	1 1/2	3/8	17 1/2	1 1/2	3/8	Stearns-SK8	25	3	3/4	96	2	3/4
Crawford-6-40	41	2	3/8	41	2	3/8	McFarlan-All	51	2 1/2	3/8	48	1 1/2	3/8	Stearns-SKL4	25	3	3/4	80	1 1/2	3/8
Cunningham-V-1	53 1/2	2 1/2	3/8	49	2 1/2	3/8	†Mercer	-----	-----	-----	47	2 1/2	3/8	Stephens-60-65	34 1/2	2	3/8	31 1/4	1 1/2	3/8
Davis-6F & 6G	39	1 1/2	3/8	36	1 1/2	3/8	†Mercer-All	-----	-----	-----	12	2 1/2	3/8	Studebaker-All	44 1/2	2	3/8	42 1/2	1 1/2	3/8
Dispatch-All	-----	-----	-----	20	1 1/2	3/4	Metz	30 1/2	1 1/4	5/8	13 1/4	1 1/4	5/8	†Stutz-C	-----	-----	-----	16 1/2	1 1/4	5/8
Dixie-L	30 3/8	1 1/4	5/8	28 3/8	1 1/4	5/8	Mitchell-C	44	2	3/8	40	1 1/2	3/8	†Stutz-C	-----	-----	-----	16 1/2	1 1/4	5/8
Dodge-All	42	2 1/4	3/8	14 3/8	1 1/4	5/8	Moline-Knight-C & G	42 1/2	2	3/8	41 1/2	1 1/2	3/8	Sun-16 & 17	34	2	3/8	32	1 1/2	3/8
Dorris-1-B-6	43 1/2	2 1/2	3/8	40	2 1/2	3/8	Monitor-All	34	1 1/4	5/8	-----	-----	Velie-15	40 3/4	2	3/8	40 1/4	2	3/8	
Dort-5A	27 1/2	1 1/2	3/8	26 1/2	1 1/2	3/8	Monroe-All	27 1/2	1 1/4	5/8	28 1/2	1 1/4	5/8	Velie-22	34 1/2	2	3/8	31 1/2	1 1/2	3/8
Elcar-All	40	2	3/8	36	2	3/8	Moon-6-40	-----	-----	-----	40	2	3/8	Westcott-All	46	2 1/2	3/8	41	1	3/8
Empire-All	37	2	3/8	35	1 1/2	3/8	Moon-6-50	-----	-----	-----	46	2 1/2	3/8	White	44	2 1/2	3/8	-----	-----	-----
Fiat-All	20	2	3/4	22	2 1/2	3/4	National-All	45	2	3/8	43 1/2	1 1/2	3/8	Winton-22-22A	48 3/4	2 1/2	3/8	44 3/4	2 1/2	3/8
*Ford-T	23 3/4	1 1/2	3/8	No lining	-----	-----	Oakland-38	35 1/4	1 1/2	3/8	34 1/4	1 1/2	3/8	-----	-----	-----	-----	-----	-----	-----

BRAKE LINING SIZES FROM 1912 TO 1922

1917 Models—Cont'd

CAR AND MODEL	EXTERNAL			INTERNAL			CAR AND MODEL	EXTERNAL			INTERNAL			CAR AND MODEL	EXTERNAL			INTERNAL		
	Length	Width	Thick-ness	Length	Width	Thick-ness		Length	Width	Thick-ness	Length	Width	Thick-ness		Length	Width	Thick-ness	Length	Width	Thick-ness
*Franklin—Series 9	28 $\frac{1}{2}$	3	3 $\frac{1}{16}$				†Mercer—All							Pullman—424	37 $\frac{1}{16}$	1 $\frac{3}{4}$	3 $\frac{5}{8}$	35 $\frac{1}{4}$	1 $\frac{3}{4}$	3 $\frac{5}{8}$
Glide—6-40	41	2	3 $\frac{1}{16}$	40 $\frac{1}{2}$	2	3 $\frac{1}{16}$	†Mercer—All				12	2 $\frac{1}{2}$	3 $\frac{1}{16}$	Regal—J	37 $\frac{1}{16}$	1 $\frac{3}{4}$	3 $\frac{5}{8}$	35 $\frac{1}{4}$	1 $\frac{3}{4}$	3 $\frac{5}{8}$
Grant—K	37 $\frac{1}{16}$	1 $\frac{3}{4}$	3 $\frac{1}{16}$	35 $\frac{1}{4}$	1 $\frac{3}{4}$	3 $\frac{1}{16}$	Metz	30 $\frac{1}{2}$	1 $\frac{3}{4}$	3 $\frac{1}{16}$	47	2 $\frac{1}{2}$	3 $\frac{1}{16}$	Reo—R & S	31 $\frac{3}{8}$	1 $\frac{3}{4}$	3 $\frac{5}{8}$	27 $\frac{1}{4}$	1 $\frac{3}{4}$	3 $\frac{5}{8}$
Hal—21 & 22	48 $\frac{1}{4}$	2 $\frac{1}{2}$	3 $\frac{1}{16}$	44 $\frac{1}{4}$	2 $\frac{1}{2}$	3 $\frac{1}{16}$	Mitchell—C	39 $\frac{1}{2}$	1 $\frac{3}{4}$	3 $\frac{1}{16}$	43	2	3 $\frac{1}{16}$	Reo—M-N-F	43	2	3 $\frac{1}{16}$	38 $\frac{1}{8}$	2	3 $\frac{1}{16}$
†Haynes—All				15 $\frac{1}{2}$	1 $\frac{3}{4}$	3 $\frac{1}{16}$	Mitchell—D	38 $\frac{1}{2}$	2	3 $\frac{1}{16}$	40	2	3 $\frac{1}{16}$	Saxon—6	43	2 $\frac{1}{4}$	3 $\frac{1}{16}$	38 $\frac{1}{8}$	2	3 $\frac{1}{16}$
Hollier—All	37 $\frac{1}{16}$	2	3 $\frac{1}{16}$	34 $\frac{1}{8}$	1 $\frac{3}{4}$	3 $\frac{1}{16}$	Moline-Knight—C	42 $\frac{1}{2}$	2	3 $\frac{1}{16}$	35 $\frac{1}{4}$	2	3 $\frac{1}{16}$	Saxon—4	43	2 $\frac{1}{4}$	3 $\frac{1}{16}$	38 $\frac{1}{8}$	2	3 $\frac{1}{16}$
Hudson—Supersix	44 $\frac{1}{2}$	2	3 $\frac{1}{16}$	39 $\frac{1}{2}$	2	3 $\frac{1}{16}$	Monitor—All	36	2	3 $\frac{1}{16}$	40	2	3 $\frac{1}{16}$	Sayers—A	21 $\frac{1}{2}$	1 $\frac{3}{4}$	3 $\frac{5}{8}$	24	1 $\frac{3}{4}$	3 $\frac{5}{8}$
Hupmobile—N	41 $\frac{1}{4}$	2	3 $\frac{1}{16}$	39 $\frac{1}{2}$	2	3 $\frac{1}{16}$	*Moon—6-66, 6-43				40	2	3 $\frac{1}{16}$	Scripps-Booth—D & H	31	1 $\frac{3}{4}$	3 $\frac{5}{8}$	21 $\frac{1}{2}$	1 $\frac{3}{4}$	3 $\frac{5}{8}$
Inter-State—T	37	1 $\frac{3}{4}$	3 $\frac{1}{16}$	36	1 $\frac{3}{4}$	3 $\frac{1}{16}$	†Nash—671	40 $\frac{1}{16}$	2	3 $\frac{1}{16}$				Scripps-Booth—G	32	2	3 $\frac{1}{16}$	27 $\frac{1}{8}$	1 $\frac{3}{4}$	3 $\frac{5}{8}$
Jackson—349 & 350	38 $\frac{1}{2}$	2	3 $\frac{1}{16}$	35 $\frac{1}{2}$	2	3 $\frac{1}{16}$	*Nash—671	20 $\frac{1}{2}$	2 $\frac{1}{2}$	3 $\frac{1}{16}$				*Seneca—17A	27 $\frac{1}{8}$	1 $\frac{3}{8}$	3 $\frac{5}{8}$	37	1	3 $\frac{5}{8}$
*Jeffery—671	40 $\frac{1}{2}$	2	3 $\frac{1}{16}$				National—All	45	2	3 $\frac{1}{16}$	43 $\frac{1}{16}$	1 $\frac{3}{4}$	3 $\frac{1}{16}$	†Seneca—17A				28	1	3 $\frac{5}{8}$
*Jeffery—671	20 $\frac{1}{2}$	2 $\frac{1}{2}$	3 $\frac{1}{16}$				Oakland—34	46	2	3 $\frac{1}{16}$	35	1 $\frac{3}{8}$	3 $\frac{1}{16}$	Singer—17	48 $\frac{1}{2}$	2 $\frac{1}{2}$	3 $\frac{1}{16}$	37	1	3 $\frac{5}{8}$
Jones—26	43 $\frac{1}{4}$	2	3 $\frac{1}{16}$	39 $\frac{1}{2}$	2	3 $\frac{1}{16}$	Oldsmobile—34	34 $\frac{1}{2}$	1 $\frac{3}{8}$	3 $\frac{1}{16}$	35	1 $\frac{3}{8}$	3 $\frac{1}{16}$	Standard—F	45	2	3 $\frac{1}{16}$	47 $\frac{1}{2}$	2 $\frac{1}{2}$	3 $\frac{1}{16}$
Jordan—B	43 $\frac{1}{4}$	2	3 $\frac{1}{16}$	38 $\frac{3}{4}$	2	3 $\frac{1}{16}$	Oldsmobile—All	38 $\frac{1}{2}$	1 $\frac{3}{8}$	3 $\frac{1}{16}$	35	1 $\frac{3}{8}$	3 $\frac{1}{16}$	Stanley—730	32 $\frac{1}{2}$	1 $\frac{3}{4}$	3 $\frac{1}{16}$	41 $\frac{1}{2}$	2	3 $\frac{1}{16}$
King—EE	45	2	3 $\frac{1}{16}$	43 $\frac{1}{2}$	1 $\frac{3}{4}$	3 $\frac{1}{16}$	Olympian—40	37 $\frac{1}{16}$	1 $\frac{3}{8}$	3 $\frac{1}{16}$	35 $\frac{1}{2}$	1 $\frac{3}{4}$	3 $\frac{1}{16}$	Stearns—SK8	25	3	3 $\frac{1}{16}$	35 $\frac{1}{2}$	1 $\frac{3}{4}$	3 $\frac{1}{16}$
Kissel—All	88 $\frac{1}{2}$	2	3 $\frac{1}{16}$				Overland—90	38	1 $\frac{3}{4}$	3 $\frac{1}{16}$	12 $\frac{1}{2}$	1 $\frac{3}{4}$	3 $\frac{1}{16}$	Stearns—SK14	25	3	3 $\frac{1}{16}$	96	2	3 $\frac{1}{16}$
Klinecar—6-38-F	67	1 $\frac{3}{4}$	3 $\frac{1}{16}$	67	1 $\frac{3}{4}$	3 $\frac{1}{16}$	Overland—85	41	2 $\frac{1}{4}$	3 $\frac{1}{16}$	10 $\frac{1}{2}$	1 $\frac{3}{4}$	3 $\frac{1}{16}$	Stevens—60-65	34 $\frac{1}{2}$	2	3 $\frac{1}{16}$	80	1 $\frac{1}{2}$	3 $\frac{1}{16}$
Klinecar—6-38-G	67	2	3 $\frac{1}{16}$	67	2	3 $\frac{1}{16}$	Owen-Magnetic—O-36	20 $\frac{1}{2}$	2 $\frac{1}{2}$	3 $\frac{1}{16}$	47 $\frac{1}{2}$	2 $\frac{1}{2}$	3 $\frac{1}{16}$	Studebaker—All	44 $\frac{1}{2}$	2	3 $\frac{1}{16}$	31 $\frac{1}{4}$	1 $\frac{3}{4}$	3 $\frac{1}{16}$
Lenox—All	78	2 $\frac{1}{4}$	3 $\frac{1}{16}$	84	2 $\frac{1}{4}$	3 $\frac{1}{16}$	Paige—6-39	53 $\frac{1}{2}$	2 $\frac{1}{2}$	3 $\frac{1}{16}$	35	2	3 $\frac{1}{16}$	†Stutz—R				42 $\frac{1}{2}$	1 $\frac{3}{4}$	3 $\frac{1}{16}$
Lexington—All	35	2	3 $\frac{1}{16}$	84	2 $\frac{1}{4}$	3 $\frac{1}{16}$	Paige—6-51	38	2	3 $\frac{1}{16}$	42	2	3 $\frac{1}{16}$	†Stutz—R				16 $\frac{1}{2}$	1 $\frac{3}{4}$	3 $\frac{1}{16}$
Liberty—10-B	37 $\frac{1}{16}$	1 $\frac{1}{2}$	3 $\frac{1}{16}$	23 $\frac{1}{2}$	1 $\frac{1}{2}$	3 $\frac{1}{16}$	Peerless—56	44	2	3 $\frac{1}{16}$	35 $\frac{1}{2}$	2	3 $\frac{1}{16}$	Velie—27	43 $\frac{1}{4}$	2	3 $\frac{1}{16}$	16 $\frac{1}{2}$	1 $\frac{3}{4}$	3 $\frac{1}{16}$
Locomobile—All	48 $\frac{1}{8}$	3	3 $\frac{1}{16}$	14 $\frac{1}{2}$	2 $\frac{1}{2}$	3 $\frac{1}{16}$	Pierce-Arrow—6-66	43 $\frac{1}{2}$	2	3 $\frac{1}{16}$	38 $\frac{1}{2}$	2	3 $\frac{1}{16}$	Velie—28	37 $\frac{1}{2}$	1 $\frac{1}{2}$	3 $\frac{1}{16}$	40 $\frac{1}{2}$	2	3 $\frac{1}{16}$
Madison	37	2	3 $\frac{1}{16}$	37	2	3 $\frac{1}{16}$	Pierce-Arrow—6-48	20 $\frac{1}{2}$	3 $\frac{1}{4}$	3 $\frac{1}{16}$	19	3	3 $\frac{1}{16}$	Westcott—S-17	44	2	3 $\frac{1}{16}$	35 $\frac{1}{4}$	1 $\frac{3}{4}$	3 $\frac{1}{16}$
Marmon—34	53 $\frac{1}{4}$	2	3 $\frac{1}{16}$	47 $\frac{1}{8}$	1 $\frac{1}{2}$	3 $\frac{1}{16}$	Pierce-Arrow—6-36-38	18 $\frac{1}{4}$	3 $\frac{1}{4}$	3 $\frac{1}{16}$	16 $\frac{1}{2}$	3	3 $\frac{1}{16}$	White	46	2 $\frac{1}{2}$	3 $\frac{1}{16}$	41	2	3 $\frac{1}{16}$
Maxwell—25	17 $\frac{1}{8}$	1 $\frac{1}{2}$	3 $\frac{1}{16}$	34 $\frac{1}{8}$	1 $\frac{1}{2}$	3 $\frac{1}{16}$	Pilot—6-45	15 $\frac{1}{4}$	3	3 $\frac{1}{16}$	13 $\frac{1}{8}$	2 $\frac{1}{2}$	3 $\frac{1}{16}$	Willys-Knight—All	44 $\frac{1}{2}$	2 $\frac{1}{2}$	3 $\frac{1}{16}$	41	2	3 $\frac{1}{16}$
McFarlan—All	54	2 $\frac{1}{2}$	3 $\frac{1}{16}$	49 $\frac{1}{2}$	2 $\frac{1}{2}$	3 $\frac{1}{16}$	Premier—6-B	34	2	3 $\frac{1}{16}$	34	2	3 $\frac{1}{16}$	Winton—All	48 $\frac{1}{4}$	2 $\frac{1}{2}$	3 $\frac{1}{16}$	13	2 $\frac{1}{4}$	3 $\frac{1}{16}$
								43 $\frac{1}{4}$	2	3 $\frac{1}{16}$	40	2	3 $\frac{1}{16}$					44 $\frac{1}{4}$	2 $\frac{1}{2}$	3 $\frac{1}{16}$

*Transmission brake.

†Both brakes internal.

*Transmission brake.

†Both brakes internal.

1918 Models

Abbott-Detroit—6-44	36	1 $\frac{1}{2}$	3 $\frac{1}{2}$	36	2	3 $\frac{1}{2}$	†Haynes—All							Paige—6-39	38	2	3 $\frac{1}{2}$	35 $\frac{1}{2}$	2	3 $\frac{1}{2}$
Allen—41	34 $\frac{1}{2}$	2	3 $\frac{1}{2}$	34 $\frac{1}{2}$	2	3 $\frac{1}{2}$	†Haynes—All							Paige—6-55	44	2	3 $\frac{1}{2}$	42	2	3 $\frac{1}{2}$
American—B	45	2	3 $\frac{1}{2}$	44	2	3 $\frac{1}{2}$	Holmes	21 $\frac{1}{2}$	2 $\frac{1}{2}$	3 $\frac{1}{2}$	15 $\frac{1}{2}$	1 $\frac{1}{2}$	3 $\frac{1}{2}$	Pathfinder—6	46 $\frac{1}{2}$	2 $\frac{1}{2}$	3 $\frac{1}{2}$	34 $\frac{1}{2}$	2 $\frac{1}{2}$	3 $\frac{1}{2}$
Apperson—8-18	49 $\frac{1}{2}$	2 $\frac{1}{2}$	3 $\frac{1}{2}$	46	2	3 $\frac{1}{2}$	Hudson—Supersix	44 $\frac{1}{2}$	2	3 $\frac{1}{2}$	40	2	3 $\frac{1}{2}$	Pathfinder—4	46 $\frac{1}{2}$	2	3 $\frac{1}{2}$	34 $\frac{1}{2}$	2	3 $\frac{1}{2}$
Auburn—6-39B	42 $\frac{1}{2}$	1 $\frac{1}{2}$	3 $\frac{1}{2}$	42	2	3 $\frac{1}{2}$	Hupmobile—R	33 $\frac{1}{2}$	2	3 $\frac{1}{2}$	39 $\frac{1}{2}$	2	3 $\frac{1}{2}$	Peerless—56	43 $\frac{1}{2}$	2	3 $\frac{1}{2}$	34 $\frac{1}{2}$	2	3 $\frac{1}{2}$
Austin—12-cyl.	42	3	3 $\frac{1}{2}$	42	3	3 $\frac{1}{2}$	Jones—27	43 $\frac{1}{2}$	2	3 $\frac{1}{2}$	39 $\frac{1}{2}$	2	3 $\frac{1}{2}$	Pierce-Arrow—6-66	20 $\frac{1}{2}$	3 $\frac{1}{2}$	3 $\frac{1}{2}$	19	3	3 $\frac{1}{2}$
Biddle—H	42	2	3 $\frac{1}{2}$	40 $\frac{1}{2}$	2	3 $\frac{1}{2}$	Jordan—C	43 $\frac{1}{2}$	2	3 $\frac{1}{2}$	38 $\frac{1}{2}$	2	3 $\frac{1}{2}$	Pierce-Arrow—6-48	20 $\frac{1}{2}$	3 $\frac{1}{2}$	3 $\frac{1}{2}$	19	3	3 $\frac{1}{2}$
Briscoe—4-24	42	2	3 $\frac{1}{2}$	40 $\frac{1}{2}$	2	3 $\frac{1}{2}$	King—F	45	2	3 $\frac{1}{2}$	43 $\frac{1}{2}$	1 $\frac{1}{2}$	3 $\frac{1}{2}$	Pierce-Arrow—6-36-38	15 $\frac{1}{2}$	3	3 $\frac{1}{2}$	13 $\frac{1}{2}$	2 $\frac{1}{2}$	3 $\frac{1}{2}$
Buick	27 $\frac{1}{2}$	1 $\frac{1}{2}$	3 $\frac{1}{2}$	27 $\frac{1}{2}$	1 $\frac{1}{2}$	3 $\frac{1}{2}$	Kissel—All	88 $\frac{1}{2}$	2	3 $\frac{1}{2}$	43 $\frac{1}{2}$	1 $\frac{1}{2}$	3 $\frac{1}{2}$	Pilot—36	36	2	3 $\frac{1}{2}$	34	1 $\frac{1}{2}$	3 $\frac{1}{2}$
E-44-45-46-47-6 cyl.	38 $\frac{1}{2}$	1 $\frac{1}{2}$	3 $\frac{1}{2}$	35	1 $\frac{1}{2}$	3 $\frac{1}{2}$	Klinecar—6-38-GA	67	1 $\frac{1}{2}$	3 $\frac{1}{2}$	67	1 $\frac{1}{2}$	3 $\frac{1}{2}$	Premier—6C	43 $\frac{1}{2}$	2	3 $\frac{1}{2}$	40	2	3 $\frac{1}{2}$
E-49-50-6 cyl.	43 $\frac{1}{2}$	1 $\frac{1}{2}$	3 $\frac{1}{2}$	40 $\frac{1}{2}$	1 $\frac{1}{2}$	3 $\frac{1}{2}$	Klinecar—6-38-H	67	2	3 $\frac{1}{2}$	67	2	3 $\frac{1}{2}$	Reo—T & U	43	2	3 $\frac{1}{2}$	38 $\frac{1}{2}$	2	3 $\frac{1}{2}$
Cadillac—57	54	2 $\frac{1}{2}$	3 $\frac{1}{2}$	51	2 $\frac{1}{2}$	3 $\frac{1}{2}$	Lenox—All	78	2 $\frac{1}{2}$	3 $\frac{1}{2}$	84	2 $\frac{1}{2}$	3 $\frac{1}{2}$	Reo—M-N-F	43	2	3 $\frac{1}{2}$	38 $\frac{1}{2}$	2	3 $\frac{1}{2}$
Campbell	37 $\frac{1}{2}$	1 $\frac{1}{2}$	3 $\frac{1}{2}$	35	1 $\frac{1}{2}$	3 $\frac{1}{2}$	Lexington—All	24	2	3 $\frac{1}{2}$	38	2	3 $\frac{1}{2}$	†Revere—All				20	1 $\frac{1}{2}$	3 $\frac{1}{2}$
Case—U	45	2	3 $\frac{1}{2}$	40	1 $\frac{1}{2}$	3 $\frac{1}{2}$	Liberty—10-B	37 $\frac{1}{2}$	1 $\frac{1}{2}$	3 $\frac{1}{2}$	23 $\frac{1}{2}$	1 $\frac{1}{2}$	3 $\frac{1}{2}$	†Revere—All				20	1 $\frac{1}{2}$	3 $\frac{1}{2}$
Chalmers—6-30	43 $\frac{1}{2}$	1 $\frac{1}{2}$	3 $\frac{1}{2}$	41 $\frac{1}{2}$	1 $\frac{1}{2}$	3 $\frac{1}{2}$	Locomobile—All	48 $\frac{1}{2}$	3	3 $\frac{1}{2}$	14 $\frac{1}{2}$	2 $\frac{1}{2}$	3 $\frac{1}{2}$	Sayers—A	31	1 $\frac{1}{2}$	3 $\frac{1}{2}$	35	1 $\frac{1}{2}$	3 $\frac{1}{2}$
Chandler—All	43 $\frac{1}{2}$	2 $\frac{1}{2}$	3 $\frac{1}{2}$	43 $\frac{1}{2}$	2 $\frac{1}{2}$	3 $\frac{1}{2}$	Lozier—82 & 84	50	3 $\frac{1}{2}$	3 $\frac{1}{2}$	35	1 $\frac{1}{2}$	3 $\frac{1}{2}$	Scripps-Booth—6-39	34 $\frac{1}{2}$	1 $\frac{1}{2}$	3 $\frac{1}{2}$	35	1 $\frac{1}{2}$	3 $\frac{1}{2}$
Chevrolet—490	45 $\frac{1}{2}$	2	3 $\frac{1}{2}$	43	1 $\frac{1}{2}$	3 $\frac{1}{2}$	Maibohm—B	38	1 $\frac{1}{2}$	3 $\frac{1}{2}$	37 $\frac{1}{2}$	1 $\frac{1}{2}$	3 $\frac{1}{2}$	Scripps-Booth—6-40	37 $\frac{1}{2}$	2	3 $\frac{1}{2}$	35	1 $\frac{1}{2}$	3 $\frac{1}{2}$
Chevrolet—F, A & D	27 $\frac{1}{2}$	1 $\frac{1}{2}$	3 $\frac{1}{2}$	27 $\frac{1}{2}$	1 $\frac{1}{2}$	3 $\frac{1}{2}$	Marmon—34	53 $\frac{1}{2}$	2	3 $\frac{1}{2}$	47 $\frac{1}{2}$	1 $\frac{1}{2}$	3 $\frac{1}{2}$	Seneca—D	34 $\frac{1}{2}$	1 $\frac{1}{2}$	3 $\frac{1}{2}$	36	1 $\frac{1}{2}$	3 $\frac{1}{2}$
Cole—870	37 $\frac{1}{2}$	1 $\frac{1}{2}$	3 $\frac{1}{2}$	34 $\frac{1}{2}$	1 $\frac{1}{2}$	3 $\frac{1}{2}$	Maxwell—25	17 $\frac{1}{2}$	2	3 $\frac{1}{2}$	34 $\frac{1}{2}$	1 $\frac{1}{2}$	3 $\frac{1}{2}$	Singer—18	37 $\frac{1}{2}$	2	3 $\frac{1}{2}$	36	1 $\frac{1}{2}$	3 $\frac{1}{2}$
Columbia—D	45	2	3 $\frac{1}{2}$	43 $\frac{1}{2}$	2	3 $\frac{1}{2}$	McFarlan—All	54	2 $\frac{1}{2}$	3 $\frac{1}{2}$	49 $\frac{1}{2}$	2	3 $\frac{1}{2}$	Standard—C	48 $\frac{1}{2}$	2 $\frac{1}{2}$	3 $\frac{1}{2}$	47 $\frac{1}{2}$	2	3 $\frac{1}{2}$
Comet—C-51	43 $\frac{1}{2}$	1 $\frac{1}{2}$	3 $\frac{1}{2}$	41 $\frac{1}{2}$	1 $\frac{1}{2}$	3 $\frac{1}{2}$	†Mercer—All				12	2	3 $\frac{1}{2}$	Stanley—All	45	2	3 $\frac{1}{2}$	41 $\frac{1}{2}$	2	3 $\frac{1}{2}$
Crawford—6-40	42 $\frac{1}{2}$	2	3 $\frac{1}{2}$	42 $\frac{1}{2}$	2	3 $\frac{1}{2}$	†Mercer—All				40	1 $\frac{1}{2}$	3 $\frac{1}{2}$	Stearns—SKL4	39	2	3 $\frac{1}{2}$	41 $\frac{1}{2}$	2	3 $\frac{1}{2}$
Cunningham—V-3	41	2	3 $\frac{1}{2}$	41	2	3 $\frac{1}{2}$	Mitchell—C	39 $\frac{1}{2}$	1 $\frac{1}{2}$	3 $\frac{1}{2}$	40	1 $\frac{1}{2}$	3 $\frac{1}{2}$	Stearns—SK8	25	3	3 $\frac{1}{2}$	41 $\frac{1}{2}$	2	3 $\frac{1}{2}$
Dixie—LS	53 $\frac{1}{2}$	2 $\frac{1}{2}$	3 $\frac{1}{2}$	49	2 $\frac{1}{2}$	3 $\frac{1}{2}$	Mitchell—D	38 $\frac{1}{2}$	2	3 $\frac{1}{2}$	35 $\frac{1}{2}$	2	3 $\frac{1}{2}$	Stearns—70-75	25	3	3 $\frac{1}{2}$	41 $\frac{1}{2}$	2	3 $\frac{1}{2}$
Dodge—All	36	1 $\frac{1}{2}$	3 $\frac{1}{2}$	36 $\frac{1}{2}$	1 $\frac{1}{2}$	3 $\frac{1}{2}$	Moline-Knight—All	38 $\frac{1}{2}$	2	3 $\frac{1}{2}$	40	2	3 $\frac{1}{2}$	Studebaker—All	43	2	3 $\frac{1}{2}$	42 $\frac{1}{2}$	2	3 $\frac{1}{2}$
Dorris—6-80	42	2 $\frac{1}{2}$	3 $\frac{1}{2}$	42 $\frac{1}{2}$	2	3 $\frac{1}{2}$	Monitor—All	36	2	3 $\frac{1}{2}$	31	1 $\frac{1}{2}$	3 $\frac{1}{2}$	†Stutz—S	44 $\frac{1}{2}$	2	3 $\frac{1}{2}$	42 $\frac{1}{2}$	2	3 $\frac{1}{2}$
Dart—All	48 $\frac{1}{2}$	2 $\frac{1}{2}$	3 $\frac{1}{2}$	46 $\frac{1}{2}$	2 $\frac{1}{2}$	3 $\frac{1}{2}$	Monroe—6	34 $\frac{1}{2}$	2	3 $\frac{1}{2}$	35	1 $\frac{1}{2}$	3 $\frac{1}{2}$	†Stutz—S				16 $\frac{1}{2}$	1 $\frac{1}{2}$	3 $\frac{1}{2}$
Douglas—G	35 $\frac{1}{2}$	1 $\frac{1}{2}$	3 $\frac{1}{2}$	35 $\frac{1}{2}$	1 $\frac{1}{2}$	3 $\frac{1}{2}$	Moore—All	36 $\frac{1}{2}$	1 $\frac{1}{2}$	3 $\frac{1}{2}$	31 $\frac{1}{2}$	1 $\frac{1}{2}$	3 $\frac{1}{2}$	†Templar—445				16 $\frac{1}{2}$	1 $\frac{1}{2}$	3 $\frac{1}{2}$
Elcar—All	47 $\frac{1}{2}$	2	3 $\frac{1}{2}$	40 $\frac{1}{2}$	2	3 $\frac{1}{2}$	*Nash—All	40 $\frac{1}{2}$	2	3 $\frac{1}{2}$	31 $\frac{1}{2}$	1 $\frac{1}{2}$	3 $\frac{1}{2}$	†Templar—445				15	2	3 $\frac{1}{2}$
Elgin—All	40	2	3 $\frac{1}{2}$	40 $\frac{1}{2}$	2	3 $\frac{1}{2}$	National—All	18 $\frac{1}{2}$	2 $\frac{1}{2}$	3 $\frac{1}{2}$	43 $\frac{1}{2}$	1 $\frac{1}{2}$	3 $\frac{1}{2}$	Tula				15	1	3 $\frac{1}{2}$
Empire—All	35 $\frac{1}{2}$	1 $\frac{1}{2}$	3 $\frac{1}{2}$	34 $\frac{1}{2}$	1 $\frac{1}{2}$	3 $\frac{1}{2}$	Oakland—34B	45	2	3 $\frac{1}{2}$	35	1 $\frac{1}{2}$	3 $\frac{1}{2}$	Velie—38	35 $\frac{1}{2}$	2	3 $\frac{1}{2}$	38	2	3 $\frac{1}{2}$
Fiat—E-17	38 $\frac{1}{2}$	1 $\frac{1}{2}$	3 $\frac{1}{2}$	37 $\frac{1}{2}$	1 $\frac{1}{2}$	3 $\frac{1}{2}$	Oldsmobile—45A	34 $\frac{1}{2}$	1 $\frac{1}{2}$	3 $\frac{1}{2}$	35	1 $\frac{1}{2}$	3 $\frac{1}{2}$	Velie—38	37 $\frac{1}{2}$	2	3 $\frac{1}{2}$	36	2	3 $\frac{1}{2}$
*Ford—T	19	2	3 $\frac{1}{2}$	19	2	3 $\frac{1}{2}$	Oldsmobile—37	38 $\frac{1}{2}$	1 $\frac{1}{2}$	3 $\frac{1}{2}$	40 $\frac{1}{2}$	1 $\frac{1}{2}$	3 $\frac{1}{2}$	Velie—38	37 $\frac{1}{2}$	2	3 $\frac{1}{2}$	36	2	3 $\frac{1}{2}$
*Franklin—Series 9	23 $\frac{1}{2}$	1 $\frac{1}{2}$	3 $\frac{1}{2}$	No lining			Olympian—45	37 $\frac{1}{2}$	1 $\frac{1}{2}$	3 $\frac{1}{2}$	35	1 $\frac{1}{2}$	3 $\frac{1}{2}$	Westcott—S-18A	43 $\frac{1}{2}$	2	3 $\frac{1}{2}$	40 $\frac{1}{2}$	2	3 $\frac{1}{2}$
*Franklin—Series 9	28	2 $\frac{1}{2}$	3 $\frac{1}{2}$				Overland—90	38	1 $\frac{1}{2}$	3 $\frac{1}{2}$	35 $\frac{1}{2}$	1 $\frac{1}{2}$	3 $\frac{1}{2}$	White	44	2	3 $\frac{1}{2}$	41	2	3 $\frac{1}{2}$
Glide—6-40	23 $\frac{1}{2}$	3	3 $\frac{1}{2}$				Overland—85-6	38	1 $\frac{1}{2}$	3 $\frac{1}{2}$	12 $\frac{1}{2}$	1 $\frac{1}{2}$	3 $\frac{1}{2}$	Willys-Knight—88	44 $\frac{1}{2}$	2	3 $\frac{1}{2}$	13	2 $\frac{1}{2}$	3 $\frac{1}{2}$
Grant—G	41	2	3 $\frac{1}{2}$	40 $\frac{1}{2}$	2	3 $\frac{1}{2}$	Owen-Magnetic—W-42	41	2 $\frac{1}{2}$	3 $\frac{1}{2}$	10 $\frac{1}{2}$	1 $\frac{1}{2}$	3 $\frac{1}{2}$	Willys—89	44 $\frac{1}{2}$	2	3 $\frac{1}{2}$	10 $\frac{1}{2}$	2 $\frac{1}{2}$	3 $\frac{1}{2}$
Harroun—AA1	37 $\frac{1}{2}$	1 $\frac{1}{2}$	3 $\frac{1}{2}$	35 $\frac{1}{2}$	1 $\frac{1}{2}$	3 $\frac{1}{2}$	Packard—All	50 $\frac{1}{2}$	2	3 $\frac{1}{2}$	20 $\frac{1}{2}$	2	3 $\frac{1}{2}$	Winton—22 & 22A	41	2	3 $\frac{1}{2}$	44 $\frac{1}{2}$	2	3 $\frac{1}{2}$
	34 $\frac{1}{2}$	2	3 $\frac{1}{2}$	35	2	3 $\frac{1}{2}$		53 $\frac{1}{2}$	2 $\frac{1}{2}$	3 $\frac{1}{2}$	47 $\frac{1}{2}$	2	3 $\frac{1}{2}$		48 $\frac{1}{2}$	2	3 $\frac{1}{2}$			

*Transmission brake.

†Both brakes internal.

BRAKE LINING SIZES FROM 1912 TO 1922

1919 Models—Cont'd

CAR AND MODEL	EXTERNAL			INTERNAL			CAR AND MODEL	EXTERNAL			INTERNAL			CAR AND MODEL	EXTERNAL			INTERNAL		
	Length	Width	Thickness	Length	Width	Thickness		Length	Width	Thickness	Length	Width	Thickness		Length	Width	Thickness	Length	Width	Thickness
Monitor	36	2	1/8	34	2	1/8	Paige-6-55	44	2	3/16	42	2	3/16	Stanley-7-35	39	2	1/4	37 1/2	2	3/16
Moon-Victory	41	1 3/4	3/16	41	1 1/2	3/16	††Paterson	43	2	3/16	42	2	3/16	††Stearns	47	2 1/2	3/16	20	1 1/2	1 1/4
Moon-6-66	42 1/2	2	3/16	37	2	3/16	**Peerless-56	19	2 1/4	3/16	38 3/8	2 1/4	3/16	††Stephens	42 3/8	2	3/16	17 1/4	2	3/16
Moore	38	1 3/4	3/16	35 1/2	1 3/4	3/16	†Phaenna-R				42	1 1/4	3/16	†Studebaker-S-H	19 3/8	2	3/16	17 3/8	1 3/4	3/16
*Nash-681	40 1/2	2	3/16				Pierce-Arrow-38	18 3/8	3 1/4	3/16	16 3/8	3	3/16	†Studebaker-EH & EG	20 3/8	2	3/16	18 3/8	1 3/4	3/16
*Nash-681	18 1/2	2 1/2	3/16				Pierce-Arrow-48	20 3/8	3 1/4	3/16	19	3	3/16	†Stutz-G	16 1/2	1 3/4	3/16	16 1/2	1 3/4	3/16
National-AL & AM	45	2	3/16	43 1/8	1 3/4	3/16	Pilot-6-45	45 3/4	2	3/16	43 1/2	1 3/4	3/16	†Templar-445	88	2	3/16	18	1	3/16
†Nelson-D				33	1 1/4	3/16	Premier-6-C	43 3/4	2	3/16	38 3/4	2	3/16	†Templar-445	81	2	3/16	18	2	3/16
†Nelson-D				33	1 1/4	3/16	Reo-T6 & U6	43	2	3/16	38 3/8	2	3/16	Tulsa-D-1-2-3	81	2	3/16	18	2	3/16
Oakland-34-B	34 3/4	1 7/8	3/16	35	1 3/8	3/16	†Revere-A-B-C							**Velie-48	19 3/8	1 3/4	3/16	42 1/2	1 1/2	3/16
Oldsmobile-37-A	38 3/8	1 7/8	3/16	35	1 3/8	3/16	†Revere-A-B-C							Westcott-A-48	44	2	3/16	41	2	3/16
††Overland-90-B	38	1 3/4	3/16	12 1/2	1 3/4	3/16	Roamer	60	1 3/4	3/16	60	1 3/4	3/16	Westcott	42 1/2	1 1/2	3/16	40 1/2	1 1/4	3/16
††Overland-4	31 3/8	2 1/4	3/16	10 1/2	1 3/4	3/16	Sayers-B	38	2	3/16	32	1 3/4	3/16	††Willys-Knight-88-8	44 1/4	2 1/4	3/16	13	2 1/4	3/16
††Overland-20	44 1/4	2 1/4	3/16	13	2 1/4	3/16	Scripps-Booth	37 3/4	1 7/8	3/16	35	1 3/8	3/16	††Willys-Knight-88-4	44 1/4	2 1/4	3/16	13	2 1/4	3/16
Packard	53 3/4	2 1/2	3/16	47 1/2	2	3/16	Seneca-H-2	37 3/4	1 3/4	3/16	35 1/4	1 3/4	3/16	Winton-24	48 3/4	2 1/2	3/16	44 3/4	2 1/2	3/16
Pan-American	44	2	3/4	40	2	3/4	Singer-19	96	2 1/2	3/16	96	2 1/2	3/16	Winton-25	52 3/4	2 1/2	3/16	49 3/4	2 1/2	3/16
Paige-6-40	38	2	3/16	35 1/4	2	3/16								††Willys Six-89-6	41	2 1/4	3/16	10 3/8	2 1/4	3/16

*Transmission brake.

**External brake in two pieces.

***Rear wheel brake in two pieces.

†Both brakes internal.

††Internal brake in two pieces.

†††Foot transmission brake, low speed and reverse bands.

†††Both brakes in two pieces.

††††Internal brake in four pieces.

1920 Models

Ace-LL							Franklin-S-9-B	28	2 3/8	3/16	23 3/8	3	3/16	Olympian-45	37 1/8	1 3/4	3/16	35 1/2	1 3/4	3/16
Allen-Series 43	38 3/8	1 3/4	3/16	34	1 3/4	3/16	Gardner							Overland-4						
American-C-6	4 3		3/16	42	2	3/16	Geronimo-6-E-45	37	1 3/4	3/16	36	1 3/4	3/16	Owen Magnetic-60						
American Beauty-6-55	26	3	3/16	26	3	3/16	Grant Six-HX	38 3/8	1 3/4	3/16	34	1 3/4	3/16	Packard-335	53 3/4	2 1/2	1 1/4	21 3/8	2	3/16
Anderson-30	43 1/2	2	3/16	41 3/8	2	3/16	Hanson-54							Paige-6-42	37 3/8	2	3/16	35 1/4	2	3/16
Apperson-821-S	48 1/2	2 1/4	3/16	44 3/4	2	3/16	Harroun-AA-2							Paige-6-55	44	2	3/16	42	2	3/16
Apperson-Anniversary							Haynes-47				31	1 3/4	3/16	Paterson-647				12 3/4	2 1/2	3/16
Auburn-639 H-K	43 1/2	2	3/16	41 3/8	2	3/16	H. C. S.							Paterson-647				16 3/8	2 3/4	3/16
Argonne-1920	48	2 1/4	3/16	20	2 1/4	3/16	Hollier-206-B							Peerless-56	19 1/4	2 1/4	3/16	38 3/4	2 1/4	3/16
Biddle-B-1							Holmes	28 1/8	3	1 1/4	41 1/2	2 1/2	1 1/4	Piedmont-6-30						
Bour-Davis-20							Hudson-O	22 1/4	2 1/2	3/16	20 3/8	2 1/2	3/16	Piedmont-6-40	16	2	3/16	14	3	3/16
Bour-Davis-21-S	43	2	3/16	43	2	3/16	Huffman Six-R	44	2	3/16	42	2	3/16	Pierce-Arrow-31	18 1/8	3 1/4	3/16	16 3/4	3	3/16
Brewster-1920				18	2	1 1/4	Hupmobile-R	33 1/8	2	3/16	33 3/8	1 3/4	1 1/8	Pierce-Arrow-51	20 3/8	3 1/4	3/16	19 3/4	3	3/16
Brewster-1920	29	2	3/16	10 1/2	1 3/4	3/16	Jordan-M	20 3/8	1 3/4	3/16	42 1/2	1 1/2	3/16	Pilot-6-45						
Briscoe-4-34	21 1/2	2	3/16				Jackson-638	35 1/4	2 1/4	3/16	15 3/4	2	3/16	Porter-45						
Briscoe-4-34	21 1/2	2	3/16				Jones-28	49 3/8	2 1/4	3/16	44 1/4	2 1/4	3/16	Premier-6-D	49 3/8	2 1/4	3/16	19 3/8	2 1/4	3/16
Buick-K-6-45	43 1/8	1 3/8	3/16	40 1/8	1 3/8	3/16	King-H	48	2 1/2	3/16	46 3/8	2 1/4	3/16	R. & V. Knight-R						
Buick-K-6-49							Kissel-45	44 1/4	2	3/16				R. & V. Knight-J	21 3/8	2 1/2	3/16	20 3/8	2 1/2	3/16
Bell							Klinekar-6-55-J	53	2	3/16	31	1 3/4	3/16	Reo-T-6	43	2	3/16	39	2	3/16
Cadillac-59	53 1/2	2 1/2	3/16	49	2 1/2	3/16	LaFayette	58	2 1/2	3/16	51 1/2	2 1/2	3/16	Revere-C	42	2 1/4	1 1/4	42	1 1/2	3/16
Case-V	48	2 1/2	3/16	46 3/8	2 1/4	3/16	Leach-B-W							Roamer-C-6-54						
Chalmers-6-30	43 1/2	1 3/4	3/16	41 3/4	1 1/2	3/16	Lexington-S-20	45	2	3/16	24 1/4	2	3/16	Roamer-D-4-75						
Champion-C-4							Liberty-10-C	20 3/8	1 3/4	3/16				Saxon-125						
Chandler-27	45 1/8	2	3/16	38 1/2	1 3/4	3/16	Liberty-10-C	23 1/8	2 1/2	3/16	48 3/8	3	3/16	Sayers Six-S-P	42 3/8	2	3/16	17 1/4	2	3/16
Chevrolet-490							Locomobile-43	14 1/2	2 1/2	3/16				Scripps-Booth-B-39	35 1/8	1 7/8	3/16	35 3/4	1 3/4	3/16
Chevrolet-F-B							Lorraine							Seneca-L	39	1 3/4	3/16	36	1 3/4	3/16
Cleveland-40	21 3/8	1 1/2	3/16	Trans mission			Maibohm-B	37 1/2	1 3/4	3/16	35 1/4	1 3/4	3/16	Severin Six						
Cleveland-40	38	2 1/2	3/16	Rear Axle			Martin-Wasp							Singer-20						
Cole-870	48	2 1/2	3/16	46 3/8	2 1/4	3/16	Marmont Touring-34-B	47	2	3/16	54	1 1/2	3/16	Skelton-35						
Columbia-D-C & CS	44	1 3/4	3/16	41 3/4	1 1/2	3/16	Maxwell-1920							Spacke-S-20						
Comet-C-53							McFarlan-127							Standard-8-1	16 3/4	2 1/2	3/16	16 3/4	1 1/4	3/16
Commonwealth-42	37 1/8	1 3/4	3/16	35 1/4	1 3/4	3/16	Mercer-Series 5							Stanley Steamer						
Crow-Elkhart-L-53-55							Meteor-K & R													
Crow-Elkhart-H-53-55							Metz-M-6	42	1 3/4	3/16	20	1 3/4	3/16	Stearns-SKL-4	47	2 1/2	3/16	(Two used)	1 1/4	3/16
Cunningham-V-4	54	2 1/2	3/16	54	2 1/2	3/16	Mitchell-7-40	40 3/4	2	3/16	40 3/4	1 1/4	3/16	Stephens-80	42 3/8	2	3/16	17 1/4	2	3/16
Douglas-G	46	2	3/16	44	2	3/16	Monitor-S-3							Studebaker-EJ-40						
Daniels-D-19	48 3/4	2 1/2	3/16	44 3/4	2 1/2	3/16	Monroe-S-9 & S-10	35	2	1 1/8	31 1/8	1 3/4	1 1/8	Studebaker-EH-50	46 3/4	2	3/16	43 1/4	1 3/4	3/16
Davis-51-55	44 3/8	2 1/2	3/16	40 3/8	2	3/16	Moon-6-48	41	1 3/4	3/16	41	1 1/2	3/16	Studebaker-EG-60						
Dispatch-G	10	1 1/2	1 1/4	10	1 1/2	1 1/4	Moore-6-68							Stutz-H						
(Uses 8 piece)							Moore-30-G	37	1 3/4	3/16	35 1/2	1 3/4	3/16	Templar-A-445	17 3/8	1	3/16	17 3/8	1	3/16
Dixie Flyer-H-S-70	19 1/4	2 1/4	3/16	14 3/4	1 3/4	3/16	Nash-682							Texas						
Dodge Brothers							Nash-681-6							Tulsa-E-1	43	2	3/16	42 1/2	2	3/16
Dorris-6-80	47 1/2	1 3/8	3/16	47 1/2	2 1/8	3/16	Nash-684							Velie-48	19 1/8	1 3/4	3/16	42 1/2	1 1/2	3/16
Dort-15	35 3/8	1 3/8	3/16	35 3/4	1 3/8	3/16	National Sextet-BB	48	2 1/2	3/16	46 3/8	2 1/4	3/16	Velie-34						
Dupont-A	47 1/2	2 1/2	3/16	47	2 1/2	3/16	Nelson-D	33	1 1/4	3/16				Vogue-655						
Economy-646							Norwalk-A-30-K							Vogue-666						
Elcar-4	35 1/4	2	3/16	38	2	3/16	Noma-1-B							Westcott-C-48	22 1/4	2 1/2	3/16	20	2 1/2	3/16
Elcar-6	35 1/4	2	3/16	38	2	3/16	Oakland-34-C	35 3/8	1 7/8	3/16	35	1 3/8	3/16	Westcott-C-38	20 1/4	1 3/8	3/16	42 1/2	1 1/2	3/16
Elgin-K	43 3/8	2	3/16	39	1 3/4	3/16	Ogren-6-60							Willys-Knight-20	44	2 1/4	3/16	13	2 1/4	3/16
Essex-A	20 3/8	1 3/4	3/16	42 1/2	1 1/2	3/16	Oldsmobile-45-B							Winther-61						
Ferris							Oldsmobile-37-A							Winton-25	53 1/2	2 1/2	3/16	40	2 1/2	3/16
Ford-T	23 3/8	1 7/8	3/16																	

BRAKE LINING SIZES FOR 1921 CARS

MOTOR AGE MAINTENANCE DATA SHEET No. 172

NAME AND MODEL	SERVICE				EMERGENCY				NAME AND MODEL	SERVICE				EMERGENCY			
	Number of Pcs. Per Drum	Total Length Per Drum	Width	Thickness	Number of Pcs. Per Drum	Total Length Per Drum	Width	Thickness		Number of Pcs. Per Drum	Total Length Per Drum	Width	Thickness				
Ace-F	1	43½	2	¾	1	41½	2	¾	Lincoln	1	49½	2½	¾	1	49½	2½	¾
Ace-L	1	43½	2	¾	1	41½	2	¾	Locomobile-48-2	1	48½	3	¾	2	29	2½	¾
Allen-43	1	38½	1¾	¾	1	34	1¾	¾	Lorraine-21-T	1	36½	2	¾	1	38	2	¾
American-C	2	68	2	¾	2	86	2	¾	Maibohm	1	37½	1¾	¾	1	35½	1¾	¾
Anderson-40	1	43½	2	¾	1	41½	2	¾	Marmon-34	1	54	2	¾	1	47½	1¾	¾
Apperson-8-21	1	48½	2½	¾	1	44½	2	¾	Maxwell-25								
Auburn-6-39	1	43½	2	¾	1	41½	2	¾	McFarlan								
Beggs-20-T									Mercer-V								
Bour-Davis-21-5	1	45	2	¾	1	43	2	¾	Merit-B								
Brewster-91	2	36	2	¾	2	21	1¾	¾	Metz-1921	2	84	1¾	¾	2	42	1¾	¾
Briscoe-4-34	1	29	2	¾	1	21½	2	¾	Meteor-R & RR	4	69½	1¾	¾	2	Cast iron		
Buick Six-44-47	1	38½	1¾	¾	1	35½	1¾	¾	Mitchell-F								
Buick Six-48-50	1	43½	1¾	¾	1	40½	1¾	¾	Monroe-S13	1	35	2	¾	1	31½	1¾	¾
Cadillac-59	1	54	2½	¾	1	51	2½	¾	Moon-6-48-21	2	40½	1¾	¾	1	42½	1¾	¾
Case-V	1	48	2½	¾	1	46½	2½	¾	Nash Four								
Champion Special									Nash Six								
Chandler Six									National Sextet-BB	1	46½	2½	¾		46	2½	¾
Chevrolet-490	1	27½	1¾	¾	1	26½	1¾	¾	Nelson-D								
Chevrolet-FB									Noma-1C								
Cleveland-40	1	38	2	¾	1	21½	1¾	¾	Oakland-34C	1	35½	1¾	¾	1	35½	1¾	¾
Climber-S-6	2	86	2½	¾	2	80	2	¾	Oldsmobile-43A	1	38½	1¾	¾	1	35½	1¾	¾
Cole-870	1	48	2½	¾	1	46½	2½	¾	Packard Single Six	2	40½	1¾	¾	1	42½	1¾	¾
Columbia-CC	2	38	1½	¾	2	78	1½	¾	Packard Twin Six	1	53½	2½	¾	2	42½	2	¾
Comet	1	43½	2½	¾	1	43½	2½	¾	Paige-6-42	1	37½	2	¾	1	35½	2	¾
Commonwealth-44									Paige-6-66	1	43½	2	¾	1	41½	2	¾
Crawford-21-6-40									Pan-A								
Crow-Elkhart-L									Pan American-E & F-6-55								
Crow-Elkhart-S									Paterson-6-50	1	41½	2	¾	2	36	2	¾
Cunningham-V-4	1	54	2½	¾	1	54	2½	¾	Peerless-56 Series	74	77	2½	¾	2	37½	2½	¾
Daniels-8	1	50½	2½	¾	1	46½	2½	¾	Piedmont-4-30	1	43	1¾	¾	1	42	1¾	¾
Davis-51	4	79	1¾	¾	2	96	1½	¾	Piedmont-6-40	1	45	2	¾	1	44	2	¾
Dixie Flyer-H-S-70	1	36	1¾	¾	1	36	1¾	¾	Pierce Arrow	1	51½	3¾	¾	2	33½	2¾	¾
Dodge Brothers	2	39	2¼	¾	2	28¾	1¾	¾	Pilot-6-50	1	44½	2	¾	1	41½	1¾	¾
Dorris-6-80									Porter-40	1	39	2½	¾		50	2½	¾
Dort-17-A	1	35½	1¾	¾	1	35½	1¾	¾	Premier-6-D	1	49½	2½	¾	2	39½	2½	¾
Dupont-A									Raleigh-A-6-60	2	42	2	¾	1	25	2	¾
Elcar-7-R	1	43½	2	¾	1	40½	2	¾	Ranger	1	37	1¾	¾	1	36	1¾	¾
Elgin Six-K	1	43½	2	¾	1	39	1¾	¾	R. & V. Knight-J	2	43½	2½	¾	2	41½	2½	¾
Essex-A	2	40½	1¾	¾	1	42½	1¾	¾	R. & V. Knight-R	1	43½	2	¾	1	41½	2	¾
Ferris-70	1	43½	2	¾	1	41½	1¾	¾	Reo-T-6	1	43	2	¾	1	38½	2	¾
Ferris-60	1	43½	2	¾	1	41½	1¾	¾	Revere-C	1	56	2½	¾	1	56	2½	¾
Ford-T									Rosmar-6-54-D	2	40	2½	¾	2	48	2½	¾
Franklin-G-B	1	23½	3	¾	1	28	2½	¾	Rock Falls-14,000	1	48	2½	¾	1	46½	2½	¾
Friend Four									Saxon-125								
Gardner-G	1	35½	1¾	¾	1	35½	1¾	¾	Sayer Six-D-P	1	42½	2	¾	2	34½	2	¾
Globe-B-10									Scrapps-Booth-B-39								
Grant Six	2	77½	1¾	¾	2	68	1¾	¾	Seneca-L & O								
Halladay									Skelton-35	1	36	1¾	¾	2	30	1¾	¾
Hanson Six-60									Standard-J	2	43½	2½	¾	2	40	2½	¾
Harroun-A-A-2									Stanwood Six								
Hatfield-A-42	1	37	1¾	¾	1	37	1¾	¾	Stearns Knight-SKL4	1	46½	2½	¾	2	37	1½	¾
Haynes-47	1	46½	1¾	¾	1	46½	1¾	¾	Stephens-90	2	45	2½	¾	2	40	2½	¾
Holmes-4	1	28½	3	¾	2	40½	2½	¾	Stevens-Duryea-E	2	30	2¼	¾				
Hudson Super Six	2	44½	2½	¾	2	40½	2½	¾	Studebaker-E. J.	2	87½	2	¾	2	79½	1¾	¾
Hupmobile-R	1	33½	2	¾	1	33½	1¾	¾	Studebaker-E. H.	2	93½	2	¾	2	86½	1¾	¾
Jackson-6-38									Studebaker-E. G.	2	93½	2	¾	2	39½	1¾	¾
Jordan-M									Stutz	2	40½	2½	¾	2	33	1¾	¾
Kenworthy-8-90									Templar-445	2	34½	1¾	¾	2	34½	1	¾
King-H	1	48	2½	¾	1	47	2½	¾	Tulsa-F-1	1	40	2	¾	1	38	2	¾
Kissel-45	2	88½	2	¾	2	88½	2	¾	Vellie-48	2	39½	1¾	¾	1	42½	1½	¾
Klinekar-6-55-K	1	38	2	¾	2	34	1¾	¾	Vellie-34	1	38½	1¾	¾	1	34	1¾	¾
Kurtz Automatic-A	1	44½	2	¾	1	41½	2	¾	Wasp-211								
LaFayette-134	1	54	2½	¾	1	51½	2½	¾	Westcott-C-38								
Leach-21-A, B & C									Westcott-C-48								
Lexington-S	1	45	2	¾	1	24½	2	¾	Wills-Sainte Claire	2	41	2	¾	2	38½	1¾	¾
Lexington-T	1	45	2	¾	1	24½	2	¾	Willys-Knight-20								
Liberty-10-C	2	40½	1¾	¾	1	23½	2½	¾	Winton Six-25								

1922 Models

Ace—C	1	49	2	$\frac{3}{4}$	1	47	2	$\frac{1}{2}$	Chevrolet—FB								
Ace—F	1	43 $\frac{1}{2}$	2	$\frac{3}{4}$	1	41 $\frac{1}{2}$	2	$\frac{3}{4}$	Cleveland—41	1	38	2	$\frac{3}{4}$	1	21 $\frac{1}{2}$	1 $\frac{1}{2}$	$\frac{3}{4}$
Ace—L	1	43 $\frac{1}{2}$	2	$\frac{3}{4}$	1	41 $\frac{1}{2}$	2	$\frac{3}{4}$	Climber Four—K	2	86	2 $\frac{1}{2}$	$\frac{3}{4}$	1	40	2	$\frac{3}{4}$
Ambassador—R	2	50	2 $\frac{1}{2}$	$\frac{3}{4}$	2	50	2 $\frac{1}{2}$	$\frac{3}{4}$	Climber Six—S	2	86	2 $\frac{1}{2}$	$\frac{3}{4}$	1	40	2	$\frac{3}{4}$
American—C	2	86	2	$\frac{3}{4}$	2	86	2	$\frac{3}{4}$	Cole—890	1	48	2 $\frac{1}{2}$	$\frac{3}{4}$	1	46 $\frac{1}{2}$	2 $\frac{1}{2}$	$\frac{3}{4}$
Anderson—Series 40	1	43 $\frac{1}{2}$	2	$\frac{3}{4}$	1	41 $\frac{1}{2}$	2	$\frac{3}{4}$	Columbia Challenger	2	38	1 $\frac{1}{2}$	$\frac{3}{4}$	2	78	1 $\frac{1}{2}$	$\frac{3}{4}$
Apperson—8-21-S	1	48 $\frac{1}{2}$	2 $\frac{1}{2}$	$\frac{3}{4}$	1	44 $\frac{1}{2}$	2	$\frac{3}{4}$	Columbia—D-C & CS	1	43 $\frac{1}{2}$	2 $\frac{1}{2}$	$\frac{3}{4}$	1	43 $\frac{1}{2}$	2 $\frac{1}{2}$	$\frac{3}{4}$
Auburn Beauty Six	1	43 $\frac{1}{2}$	2	$\frac{3}{4}$	1	41 $\frac{1}{2}$	2	$\frac{3}{4}$	Comet—C-53	2	38 $\frac{1}{2}$	2 $\frac{1}{2}$	$\frac{3}{4}$	2	32	2	$\frac{3}{4}$
Beggs—20T									Crawford—22-6-60		36	$\frac{3}{4}$	$\frac{3}{4}$		54	2 $\frac{1}{2}$	$\frac{3}{4}$
Bell—4-32	2	69	2	$\frac{3}{4}$	2	33 $\frac{1}{2}$	1 $\frac{3}{4}$	$\frac{3}{4}$	Cunningham—U-4	1	54	2 $\frac{1}{2}$	$\frac{3}{4}$	1	54	2 $\frac{1}{2}$	$\frac{3}{4}$
Bell—6-50	2	78	2	$\frac{3}{4}$	2	37	2	$\frac{3}{4}$	Daniels—D-19	1	50 $\frac{1}{2}$	2 $\frac{1}{2}$	$\frac{3}{4}$	1	49 $\frac{1}{2}$	2 $\frac{1}{2}$	$\frac{3}{4}$
Biddle—B1 & B5									Davis—71								
Brewster—91	2	36	2	$\frac{3}{4}$	2	21	1 $\frac{3}{4}$	$\frac{3}{4}$	Davis—61-67	4	79	1 $\frac{3}{4}$	$\frac{3}{4}$	2	86	1 $\frac{1}{2}$	$\frac{3}{4}$
Buick 1922—34-5-6-7	1	34	1 $\frac{1}{2}$	$\frac{3}{4}$	1	32 $\frac{1}{2}$	1 $\frac{1}{2}$	$\frac{3}{4}$	Dixie Flyer—H-S-70	1	38	1 $\frac{3}{4}$	$\frac{3}{4}$	1	36	1 $\frac{3}{4}$	$\frac{3}{4}$
Buick 1922—44-5-6-7	1	38 $\frac{1}{2}$	1 $\frac{1}{2}$	$\frac{3}{4}$	1	35 $\frac{1}{2}$	1 $\frac{1}{2}$	$\frac{3}{4}$	Dodge Brothers	2	38 $\frac{1}{2}$	2 $\frac{1}{2}$	$\frac{3}{4}$	2	28 $\frac{3}{4}$	1 $\frac{3}{4}$	$\frac{3}{4}$
Buick 1922—48-9-50	1	43 $\frac{1}{2}$	1 $\frac{1}{2}$	$\frac{3}{4}$	1	40 $\frac{1}{2}$	1 $\frac{1}{2}$	$\frac{3}{4}$	Dorris—6-80	2	41	2 $\frac{1}{2}$	$\frac{3}{4}$	2	41	2 $\frac{1}{2}$	$\frac{3}{4}$
Cadillac—61		54	1 $\frac{1}{2}$	$\frac{3}{4}$		51	1 $\frac{1}{2}$	$\frac{3}{4}$	Dort-19-14	1	35 $\frac{1}{2}$	1 $\frac{1}{2}$	$\frac{3}{4}$	1	35 $\frac{1}{2}$	1 $\frac{1}{2}$	$\frac{3}{4}$
Case—X	1	48	2 $\frac{1}{2}$	$\frac{3}{4}$	1	46 $\frac{1}{2}$	2 $\frac{1}{2}$	$\frac{3}{4}$	Driggs								
Case—V	1	48	2 $\frac{1}{2}$	$\frac{3}{4}$	1	46 $\frac{1}{2}$	2 $\frac{1}{2}$	$\frac{3}{4}$	Duesenberg—Str	82	29	2 $\frac{1}{2}$	$\frac{1}{4}$	2	15	2 $\frac{1}{2}$	$\frac{1}{4}$
Champion—Tourist									DuPont—A		48	2 $\frac{1}{2}$	$\frac{3}{4}$		48	2 $\frac{1}{2}$	$\frac{3}{4}$
Champion—Special									Durant—A-22		37 $\frac{1}{2}$	2	$\frac{3}{4}$		35 $\frac{1}{2}$	1 $\frac{3}{4}$	$\frac{3}{4}$
Chandler Six									Durant—B-22								
Chevrolet—490	1	27 $\frac{1}{2}$	1 $\frac{1}{4}$	$\frac{3}{4}$	1	26 $\frac{1}{2}$	1 $\frac{1}{4}$	$\frac{3}{4}$	Earl—40	1	40 $\frac{1}{2}$	2	$\frac{3}{4}$	1	21 $\frac{1}{2}$	2	$\frac{3}{4}$

BRAKE LINING SIZES FOR 1922 CARS

MOTOR AGE MAINTENANCE DATA SHEET No. 173

1922 Models—Cont'd

NAME AND MODEL	SERVICE				Thickness	EMERGENCY				NAME AND MODEL	SERVICE				Thickness	EMERGENCY				Thickness
	Number of Pcs. Per Drum	Total Length Per Drum	Width	Thickness		Number of Pcs. Per Drum	Total Length Per Drum	Width	Thickness		Number of Pcs. Per Drum	Total Length Per Drum	Width	Thickness		Number of Pcs. Per Drum	Total Length Per Drum	Width	Thickness	
Elcar—K-1	1	43½	2	¾	1	41½	2	¾	Oldsmobile—43-A	1	38½	17½	¾	1	35½	15½	¾			
Elcar—7-R	1	43½	2	¾	1	41½	2	¾	Oldsmobile—46	1	43½	17½	¾	1	40½	15½	¾			
Elgin—K-1	1	43½	2	¾	1	39	1¾	¾	Oldsmobile—47	1	38½	17½	¾	1	35½	15½	¾			
Essex—A	2	40½	1¾	¾	1	42½	1½	¾	Packard—Single Six	1	45	1¾	¾	1	39½	1½	¾			
Falcon—H. P. M. 12-D22	1	43½	2	¾	1	41½	1¾	¾	Packard—Twin Six	1	53½	2½	¾	2	42½	2	¾			
Ferris—Series 60	1	43½	2	¾	1	41½	1¾	¾	Paige—6-44	1	37½	2	¾	1	35½	2	¾			
Ferris—Series 70	1	43½	2	¾	1	41½	1¾	¾	Paige—6-66	1	49½	2	¾	1	48½	2	¾			
Ford—T	1	23½	3	¾	1	28	2½	¾	Peterson—22-6-52	1	41½	2	¾	2	36	2	¾			
Franklin—9B	1	23½	3	¾	1	28	2½	¾	Peerless—56-S-7	2	38½	2½	¾	1	38½	2½	¾			
Gardner—T-R & G	1	35½	1¾	¾	1	35½	1¾	¾	Piedmont—4-30	1	43	1¾	¾	1	42	1¾	¾			
Goodspeed	1	35½	1¾	¾	1	35½	1¾	¾	Piedmont—6-40	1	45	2	¾	1	44	2	¾			
Grant	2	77½	1¾	¾	2	68	1¾	¾	Pierce-Arrow	1	51½	3¾	¾	2	33½	2¾	¾			
H. C. S.	1	36	1¾	¾	1	36	1¾	¾	Pilot—6-45	1	43½	2	¾	1	39	1¾	¾			
Halladay—4	1	36	1¾	¾	1	36	1¾	¾	Pilot—6-50	1	39	2½	¾	1	50	2½	¾			
Halladay—6	1	36	1¾	¾	1	36	1¾	¾	Porter—46	1	50½	2½	¾	1	46½	2½	¾			
Handley-Knight	2	44½	2½	¾	2	40	2½	¾	Premier—6-D	1	43½	1¾	¾	1	42	1¾	¾			
Hanson—30	1	42	1¾	¾	1	35	1¾	¾	Premocor—6-40-A	1	43½	2	¾	1	41½	2	¾			
Hanson Six—60	1	36	1¾	¾	1	35	1¾	¾	R. & V. Knight—R	2	43½	2½	¾	2	41½	2½	¾			
Hatfield—A-42	1	40½	2½	¾	1	45½	1¾	¾	R. & V. Knight—J	1	43	2½	¾	1	39	2	¾			
Haynes—75	1	40½	1¾	¾	1	46½	1¾	¾	Reo Series—B-T6 & U6	1	56	2½	¾	1	56	2½	¾			
Haynes—55	1	40½	1¾	¾	1	46½	1¾	¾	Revere—C	1	43½	2	¾	2	47	2	¾			
Holmes—Series 4	1	28½	3	¾	2	41	2¼	¾	Rickenbacker—A	1	43½	2	¾	2	48	2½	¾			
Hudson—Super Six	2	43½	2½	¾	2	40	2½	¾	Roamer—6-54-E	2	40	2½	¾	2	48	2½	¾			
Huffman—R	1	33½	2	¾	1	33½	1¾	¾	Roamer—4-75-E	2	40	2½	¾	2	48	2½	¾			
Hupmobile—Series R	1	33½	2	¾	1	33½	1¾	¾	Rolls Royce	6	33½	2	¾	Cast iron	1	23	2½	¾		
Jackson—638	2	85	1½	¾	1	20½	1¾	¾	Romer—R-22	1	24	2½	¾	1	54	2½	¾			
Jordan—MX	2	85	1½	¾	1	20½	1¾	¾	Rock Falls—14,000	1	54	2½	¾	1	54	2½	¾			
Jordan—F	2	45	2½	¾	1	20	2½	¾	Saxon—125	1	44½	2	¾	1	41½	2	¾			
Kenworthy—8-90	1	48	2½	¾	1	46½	2½	¾	Sayers Six—DP	1	42½	2	¾	2	34½	2	¾			
King—K-1922	2	39½	2	¾	2	39½	2	¾	Seneca—50 & 51	1	37½	1¾	¾	1	35½	1¾	¾			
Kissel—45	1	38	2	¾	2	34	1¾	¾	Seneca—L & O	1	36	1¾	¾	1	37	1¾	¾			
Klinekar—6-55-K	1	38	2	¾	2	34	1¾	¾	Southern Six—660-2	2	43½	2½	¾	2	40	2½	¾			
LaFayette	1	54	2½	¾	1	51½	2½	¾	Sperling—A	1	39	2	¾	1	37½	2	¾			
Leach—999	1	45	2	¾	1	24½	2	¾	Standard—J	2	43½	2½	¾	2	40	2½	¾			
Lexington—S	1	45	2	¾	1	24½	2	¾	Stanley Steamer	1	39	2	¾	1	37½	2	¾			
Lexington—T	1	45	2	¾	1	24½	2	¾	Stanwood Six	1	34	2	¾	2	34	2	¾			
Liberty—10-D	2	40½	1¾	¾	1	23½	2½	¾	Stearns—SKL-6	1	46	2½	¾	2	36½	1½	¾			
Lincoln	1	49½	2½	¾	1	40½	2½	¾	Stephens—90	2	44½	2½	¾	1	20	2½	¾			
Locomobile—48	1	48½	3	¾	2	29	2½	¾	Stevens-Duryea—E	2	30	2½	¾	Bronze	2	79½	1¾	¾		
Maibohm—B	1	43½	2	¾	1	39	1¾	¾	Studebaker—Light Six	2	87½	2	¾	2	86½	1¾	¾			
Marmen—34	1	54	2	¾	1	47½	1½	¾	Studebaker—Special Six	2	93½	2	¾	2	39½	1¾	¾			
Maxwell	1	54	2	¾	1	47½	1½	¾	Studebaker—Big Six	2	93½	2	¾	2	39½	1¾	¾			
McFarlan—1922	1	50½	2½	¾	1	46½	2½	¾	Stutz	2	40½	2½	¾	2	33	1¾	¾			
Mercer—Series 5	2	24	2½	¾	2	34½	2½	¾	Templar—A-445	2	34½	1¾	¾	2	34½	1	¾			
Merit	1	44	2	¾	1	39	1¾	¾	Texas—A-38	1	40	2	¾	1	38	2	¾			
Meteor—R & RR	4	69½	1	¾	2	Cast iron	1	¾	Tulsa—E-1-2-3	2	39½	1¾	¾	1	42½	1¾	¾			
Meteor—R & RR	4	69½	1¾	¾	2	Cast iron	1	¾	Vellie—48	1	40	2	¾	1	38	2	¾			
Mitchell—F-50	1	35	2	¾	1	31½	1¾	¾	Vellie—34	2	39½	1¾	¾	1	42½	1¾	¾			
Monroe 1922—S-13	1	35	2	¾	1	31½	1¾	¾	Vellie—58	2	39½	1¾	¾	1	42½	1¾	¾			
Moon—6-48	2	40½	1¾	¾	1	42½	1½	¾	Vogue—6-55	2	39½	1¾	¾	1	42½	1¾	¾			
Murray—Mac-Six	2	40½	1¾	¾	1	42½	1½	¾	Vogue—6-66	2	39½	1¾	¾	1	42½	1¾	¾			
Nash—691-96-97	2	40½	1¾	¾	1	42½	1½	¾	Waltham—6	2	84	1¾	¾	2	42	1¾	¾			
Nash—692-94-95	2	40½	1¾	¾	1	42½	1½	¾	Washington	1	43½	2	¾	1	39	1¾	¾			
Nash Four—41-4	2	40½	1¾	¾	1	42½	1½	¾	Westcott—C-48	2	40½	1¾	¾	1	22½	2	¾			
National—BB	1	46½	2½	¾	1	46	2¼	¾	Westcott—A-44	2	40½	1¾	¾	1	22½	2	¾			
Noma—3C	1	46½	2½	¾	1	46	2¼	¾	Wills Sainte Claire—A-68	2	41	2	¾	2	38½	1¾	¾			
Noma—1D	1	46½	2½	¾	1	46	2¼	¾	Willys-Knight—20	2	41	2	¾	2	38½	1¾	¾			
Norwalk—430-KS	2	85	2	¾	2	82	2	¾	Winter—61	2	44	2½	¾	1	24	2	¾			
Oakland—6-44	1	35½	1¾	¾	1	35½	1¾	¾	Winton—40	1	50½	2½	¾	1	46½	2½	¾			
Ogren—6-T-DeLuxe	1	48	2	¾	1	48	2	¾												

OWEN TIRE LISTS ASSETS

Cleveland, April 3—The assets of the Owen Tire and Rubber Co., of this city, are placed at \$713,245.55 and the liabilities at \$987,597, in a statement which has been filed in the United States District Court here by the Receiver M. Scott. There are more than 150 pages of claims against the company set forth in the report. Most of them are for small amounts. The company was organized during the war, and got into production when trade in the industry slumped.

OPTIMISM IN NEWARK

Newark, April 4—More optimism to the square inch than could have been found almost anywhere in the last eighteen months was perceptible at the Fifteenth Annual Banquet of the Newark Automobile Trade Assn. here.

There were several reasons for it but foremost among them was the fact that the Newark territory is absorbing more automobiles per day right now than at any time since the peak of boom days. The buying started about the time the show opened two weeks ago and since then both new and used cars have climbed rapidly. The banquet was attended by more than 500 dealers, salesmen and their friends.

NEW DEPARTURE INCREASES OUTPUT

Bristol, Conn., April 3—The New Departure Mfg. Co. is steadily increasing its output and there now are 2,300 men on the payroll, an increase for the first three months of this year equal to the increase in the entire previous year.

FORD PRODUCTION AT CAPACITY

Chicago, April 4—The Ford Chicago Branch started at capacity production of 240 cars a day, April 1. A. W. L. Gilpin, sales manager, announces that the number of cars turned out under the new five-day week plan will be somewhat over this average.

PREDICTS HIGHER PRICES

Buffalo, April 4—Speaking before the members of the Buffalo Automobile Dealers' Assn., George Graham, vice-president of the Chandler Motor Car Co. of Cleveland, and former vice-president and general manager of the Pierce-Arrow Motor Car Co., said that prosperity will return in a relatively short time. Prices of automobiles will go up because better materials are being used in making them, he said.

MOTOR AGE

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The Summer Service Issue

IN placing before you this copy of the Summer Service Issue, we hope that we are rendering to you a service that will be worth while. Our objective in this number is to indicate to you that the automotive dealer business is not so rotten after all; that it is well founded and that it is a going business that is going much farther in the next few years.

We hope to impress upon you some of the possibilities that are before you and some of the neglected possibilities within reach at present. It is not so much as to how you are going to expand by buying more equipment, renting larger quarters and making other obvious moves for expansion, but how you are going to use the equipment you have and take advantage of the opportunities that have been neglected.

There are splendid establishments in the automotive dealer field, probably none perfect. Each dealer knows of other establishments where some one thing is done better than he is doing it. Why not get busy at once and do this thing as well as the other man? That is the idea that we want to bring home. Probably the mass of automotive dealer establishments are not as nearly perfect as the dealer establishments in some other lines. There is a reason for this. In no other line has there been the quick development of the dealer field as in this line, and no other line has grown without precedent as this one has. Now

that we have laid the foundation, and despite many statements to the contrary, it is not an entirely unsound foundation, let us all get busy and fill the crevices and point up the joints so that we will have an entirely serviceable and well-looking basis for our structure.

It is a tribute to the automotive industry that this issue of MOTOR AGE is not entirely the kind of an issue that served at the time the designation was selected. Then there were distinct Summer Service problems. Late each spring the cars were taken from the woodsheds, barns and, in some instances, garages and tuned up for the summer season. Today spring does not bring its special problems nor is there any date for overhauling the car. Generally the car has been used all winter and the special spring work does not differ much from that of the annual house cleaning of the housewife. Chiefly the special spring work is mostly of a social nature, that of preparing for a better appearance. If you have not abused the car by using destroying compounds in the radiator or letting it freeze, there is not much to do except to run it on a greasing rack and prepare for the longer and swifter drive.



Can You Afford to Be Without An— Arbor Press?

A HAMMER legitimately used is one of the most needed tools in the repairing of motor vehicles. The trouble is that in many cases it is misused. No one skilled in the handling of tools and machinery likes to go into a shop and see a man pounding away unmercifully on a piece of work when such an operation can be performed with apparatus much more suited to the work.

Arbor presses, both large and small, are among the most useful pieces of machinery in any automobile shop. A much better job of forcing bushings in and out, pinions from driveshafts, straightening bent parts, etc., can be done with an arbor press than with a hammer and a piece of steel rail. Many a good vise has been spoiled by a mechanic clamping in it a large piece of work and then hammering upon it with the largest hammer he could find. The work also is ruined very often from hammer dents and chips breaking off.

With an arbor press a mechanic easily can force out the most obstinate bushing or collar which has become "frozen" to a shaft. He can do it better, in much less time and incidentally cut out a lot of noise, all of which builds up shop morale. Can you afford to be without an arbor press?



When You Need It You Need It Badly

IT IS surprising to note the few number of cars equipped with fire extinguishers. Apparently the possibility of fire as regards a motor car is considered well nigh impossible. By virtue of its construction, the motor vehicle is susceptible to catching fire. The fire protection afforded by the fire departments of the cities and villages is effective only when the vehicle is in that particular vicinity. This protection cannot be carried with the car when it is out on the open road. When the automobile is outside the settled district, it is dependent on itself for protection against fires. Because a comparatively few cars have been lost through fire there exists a feeling of security against it that is false. We hear a great deal about Safety First but very little about fire extinguishers for automobiles. The hand chemical extinguisher belongs in the first line defense in the army of Safety First.

Why do not the car makers include this safeguard as part of the regular factory equipment?

Why Not Cash In?

THE AUTOMOTIVE INDUSTRY IS ABOUT 25 YEARS OLD. The exact age depends upon when you cease to consider it an adventure and begin to call it an industry. The exact period is not material.

There are a few dealers who have been in this industry since the beginning and these men have honorable business careers. They are worth-while men. Some of them are in the large cities and some in the smaller. Most of them have prospered.

There are many dealers who have been in the industry more than 15 years. These men have records similar to those above mentioned.

But when you get down to the post-war period you must discriminate as to your selection of dealers—be they car, truck, tractor, maintenance, accessory or any other kind of dealers.

THIS was the adventure period of automotive dealerships. In previous years there had been many adventurers in this business but in the natural course of events they were washed out—as the extremely heavy mortality proves. There has been a great turnover in all the years of automotive dealerships, but as in all other business, it has been a survival of the fittest.

The last year has been another period of washing out, and a good many of the unworthy and some of the worthy have fallen out of the list. The worthiest have remained but, unfortunately, so have some of the others. This is due to the fact that so much money was made by some of these men during 1918 and 1919 that they are able to support themselves over this period. Also that many persons still are careless buyers of automotive merchandise, including maintenance.

But the time is here to "cash in."

LET'S pull together, put on higher standards of merchandising, higher standards of maintenance of all kinds and demand a higher standard of merchants, salesmen and mechanics in this great business of ours.

IT IS THE GREATEST BUSINESS IN THE WORLD TODAY.

Transportation always has been the greatest business and will continue to be so.

We have in our industry the best transportation facilities of today, so we must have the greatest business of today.

And as our proposition is fundamental, we will continue to have the greatest business of

the day until a better means of transportation is devised.

That means of transportation is not yet on the horizon. Some have hailed air travel as this means—and it may be—but aircraft is a close kindred of our own business and our industry is best equipped to handle the aircraft if it should reach the popular stage.

We have the business future and it is time we brought the personnel up to the business.

WE can "cash in" only when we make our business safe in the public minds. Here are some thoughts for the future:

We cannot deny that the maintenance branch of the industry needs a house cleaning. This is evidence that a minority of maintenance dealers are incompetent, dishonest, and poor merchants. They destroy confidence of the public and their dirty shops are a menace to the industry.

The Washington State Automotive Association and the California Association have done a good work in cleaning up such places and placing the maintenance work in these sections in good shape.

There are vehicle dealers whose chief objective is to swindle the banker, the investment banker or the public. Local associations, state associations and the N. A. D. A. have made progress in eliminating these men, but the effort has failed largely because the association members have not taken this phase of the work seriously enough.

IF all the worthy members of the dealer end of this industry would get together and make an earnest endeavor to make these associations what they should be, and to give to them a proper objective and a proper standing, there would be no question as to the "cash in."

There are too many dealers in this industry who will accept for sale any flimsy contraption or patent medicine that promises a temporary profit.

Why not raise the standard of our business by making closer restrictions on the merchandise we handle? Two-thirds of the dealers who handle this flimsy stuff know that it is not worth while. They are selling their birth-right for a mess of pottage.

ONLY WORTHY MEN AND WORTHY METHODS CAN—IN THE END—SUCCEED. WE HAVE A WORTHY BUSINESS, SO WHY CONTINUE TO HOLD IT BACK BY UNWORTHY METHODS?

Best Month Since August, 1920

March Gain Applies to Cars, Trucks, Tractors and Parts

Passenger Car Output for First Quarter Far Ahead of Same Period Last Year

NEW YORK, April 4.—March probably was the best month the automotive industry has had since August, 1920.

While detailed figures are not available, the output of Ford provides the only element of doubt. Practically all the other large producers turned out more motor vehicles than in any 30-day period in a year and a half.

This applies to all branches of the industry—passenger cars, trucks, tractors and parts. Passenger car output for the first quarter ran far ahead of the same period in 1921. The first quarter of 1920 was the largest the industry ever had. Truck production in the first three months of this year gained even more in comparison with the opening quarter of 1921.

Sales of parts manufacturers in March were as large as in any month of 1921, and probably larger. The February total showed an increase of more than 100 per cent over the same month last year and was larger than in March of last year, which showed an increase of 93 per cent over February. A gain of only about 20 per cent for March of this year over the preceding month would put parts sales on a level with the banner month of last year. There is little doubt that an even larger increase will be shown.

Carload shipments of automobiles and trucks in February numbered 19,600. The only months in a year and a half which have exceeded this figure were September, 1920, with 20,804; April, 1921, with 20,187; June, 1921, with 20,269; August, 1921, with 20,350, and September, 1921, with 20,150. Unless there was an unexpectedly large falling off in Ford output for March, 1922, the carload shipments are almost certain to exceed any of those months.

While it is not expected that the sale of motor vehicles will continue to show such astonishing gains for the rest of the year as compared with 1921, it now can be stated definitely that the volume of business will be larger than last year. Unless some entirely unforeseen obstacles arise to retard the general recovery of the country from industrial depression, truck manufacturers and parts makers are certain to have a materially larger volume of business than they did in 1921.

The only element of doubt is in the passenger car field, and it now appears highly probable that earlier predictions that the volume of sales would not exceed those of 1921, when they approximated 1,500,000, were too conservative.

Within the past few weeks strong im-

petus has been given to the sale of small and medium sized tractors. This reflects improved conditions in the agricultural sections of the country. The same improved tone has been apparent in the truck market in these districts, and farmers are even showing renewed interest in inexpensive passenger cars.

Dealers in all sections of the country report better business. A large number of them frankly express surprise at the volume of their sales. Factories turning out the more popular makes of cars are having difficulty in keeping abreast of orders and no large surplus is being built up in anticipation of increased demand later.

Milton Wins 50-Mile Race in 26 Minutes One Second

Los Angeles, April 2.—"Tommy" Milton won the feature event on the program at Beverly Speedway. He made the 50 miles in 26 minutes and one second, an average of 115 and one-fifth miles an hour. The 50-mile race was the final after four 25-mile qualifying heats. Murphy finished second, Hartz third, Bordino fourth. The other starters were Klein, Elliott and Sarles.

A crowd of 35,000 saw the races which were for a purse of \$15,000.

SUES FORD FOR \$11,000,000

Miami, Fla., April 3.—Damages amounting to \$11,000,000 are asked in a suit filed here against Henry Ford by Edward S. Huff, an electrical engineer. Huff asserts that he originated the magneto now in use on Ford cars and that he never has been paid in full for his invention.

Detroit, April 3.—The Ford Motor Co. announces that it does not take seriously the suit filed by Edward S. Huff in Florida to recover \$11,000,000 alleged to be due on magnetos. The Ford company says it knows nothing of Huff but that the question of patent rights on magnetos was settled some time ago.

ELGIN DEALERS ORGANIZE

Elgin, Ill., April 4.—A meeting of the automobile dealers and allied trades held here resulted in the formation of the Elgin Automotive Trade Assn. The officers are: O. S. Salisbury, President; Claude P. Wing, First Vice-President; Howard McBride, Treasurer; H. P. Bouffleur, Secretary.

William Barnard, secretary of the Elgin Motor club, was appointed executive secretary of the association and headquarters will be established jointly with the club.

USED CAR MARKET SUCCESSFUL

Charlotte, N. C., April 1.—A dozen sales in one week is the record of the promoters of the used car market here, which opened last week.

General Motors Sales 66,000 Cars for First Three Months

This Compares With 30,023 in Corresponding Period of Last Year

NEW YORK, April 1.—Directors of the General Motors Corp. at a meeting here declared the regular quarterly dividend upon the preferred and debenture stocks. The dividend on the common was again passed.

At the close of the meeting the following statement on the business outlook was made by Pierre S. duPont, president of the corporation:

"The position of the corporation is very satisfactory to us. Bank loans, which now stand at \$41,140,000 have been reduced \$7,800,000 since the beginning of the year, and cash which now stands at \$37,000,000, decreased only \$3,000,000, making a net improvement in cash position of \$4,800,000.

"While it may be several weeks before final figures of sales of motor cars for the first quarter of 1922 will be available, the preliminary figures are most encouraging. Sales for January were 16,080, February 20,664 and sales for March will be approximately 30,000 cars, a total of 66,000. This compares with 58,488 cars in the previous quarter and, further, with 30,023 for the first quarter of last year.

"All divisions of the corporation are enjoying a substantial increase in business, and reports from our distributors and dealers indicate a strong retail demand for our product this spring and summer."

International Harvester Profits Greatly Reduced

Chicago, April 3.—The International Harvester Company for 1921 reports gross sales of \$121,215,000, a reduction of 45 per cent from the total for 1920. The net profit for the year was \$4,149,000, compared with \$16,655,300 the year before. The business done in this country produced no profit, says the report, the profit shown having been derived entirely from the company's foreign trade.

DE PALMA ENTERS RACE

Indianapolis, April 4.—Ralph DePalma has entered the lists for the Tenth Annual 500-mile International Sweepstakes on the Indianapolis Motor Speedway next Memorial Day.

SHALER CO. WINS SUIT

Waupun, Wis., April 3.—A decision favoring the C. A. Shaler Co. has been rendered by Judge Page in a patent infringement suit against Risk's Riskless Vulcanizer Co.

All Durant Plants to Make Stars

Truck Makers Organize National Association

**Purpose is to Improve Conditions
in the Industry—Martin
L. Pulcher is President**

DETROIT, April 1—Martin L. Pulcher, vice-president and general manager of Federal Motor Truck Co., was elected president of the new National Association of Motor Truck Industries at a meeting here this week. The purpose of the association is to improve conditions in the motor truck industry. H. T. Boulden, vice-president of the Selden Truck Corp., was elected first vice-president; B. A. Gramm, vice-president of Gramm Motor Truck Co., second vice-president; Moie Cook, secretary of the Service Motor Truck Co., secretary; A. S. More, president Denby Motor Truck Co., treasurer. Don F. Whittaker, former general manager of the National Association of Motor Truck Sales Managers, which is merged into the new association, is retained as manager of the new organization.

These officers with J. W. Stephenson, vice-president of the Indiana Truck Corp., Homer Hilton, vice-president of Winther Motors, Inc., F. G. Elder, vice-president of Day-Elder Motors Corp., and J. E. Tracy, vice-president of the Parker Motor Truck Corp., comprise the board of directors.

Great Increase in Sales of Medium Priced Cars

New York, April 3—New passenger cars registered in 10 counties in and around New York numbered 4806 in January and February, as compared with 2247 in the same months last year.

Registration figures compiled by Sherlock & Arnold, publishers of the Automobile Sales Analysis, largely subscribed to by dealers, may be tabulated as follows:

Cars Below \$2500			
	1922	1921	
January	2019	483	
February	2231	1409	
Total	4250	1892	
Cars \$2500 and Above			
	1922	1921	
January	283	273	
February	145	210	
Total	556	355	

STEWART-WARNER WINS SUIT

Chicago, April 1—The application of the Stewart-Warner Speedometer Corp. for an injunction to prohibit the manufacture and distribution of vacuum gasoline feed tanks by Ireland & Matthews of Detroit, has been granted by the federal court at Detroit, the decree having

been entered March 30. The decree also ordered the Ireland & Matthews company to render an accounting to the Stewart-Warner company on account of infringement of the latter's patents.

It was held by the court that the Webb Jay patents covering the vacuum gasoline feed system, owned by the Stewart-Warner company, were infringed by the Weinberg tank, which was the type manufactured by Ireland & Matthews. Stewart-Warner has won a number of other similar suits against other manufacturers.

150 Cars in Minneapolis "Repair it Now" Parade

Minneapolis, April 3—Repair work on automotive apparatus, particularly on motor cars, was given a spurt by means of a parade through the loop district March 30 of 150 service cars each bearing the slogan, "Repair It Now." The demonstration was arranged by the Garage Owners pursuant to a proclamation by Mayor George E. Leach supporting the national campaign for early repairs.

President W. J. Potts of the association says the garages are full up with mechanics, but could hire more if owners would not wait until June 1 to have spring work done.

Plans for New Zedar Car Said to Be Almost Ready

New York, April 1—Negotiations for the promotion of a company which will build a new automobile to be designed by F. M. Zedar at the plant of the Cleveland Tractor Co., approached completion at a series of conferences held here within the past few days. A complete announcement of the plans which have been worked out is expected in the near future.

STANDARD ANNOUNCES NEW PRICES

Pittsburgh, Pa., April 3—The Standard Motor Car Co., Inc., announces price reduction ranging from \$900 to \$1600. They are:

	New price	Old price
7-passenger phaeton.....	\$2500	\$3400
4-passenger sport.....	3500	3400
2-passenger roadster.....	2500	3400
4-passenger coupe.....	2750	4500
4-passenger sedanette.....	3000	4500
7-passenger sedan.....	3200	4800

USED CARS SELLING WELL

Philadelphia, April 1—Sales of new cars here are fair and show some improvement in volume over last month. Used cars continue to sell remarkably well. The market for general automotive equipment shows slight improvement.

Production of 20,000 Cars A Month by Jan. 1 Planned

**Order for 250,000 Continental Engines Placed at
Detroit**

NEW YORK, April 3—Announcement is made by Durant Motors, Inc., that the new Star car will be built in all its divisional plants. This includes factories at Long Island City, Lansing, Muncie, Oakland, Cal., and Toronto.

The Long Island City and Lansing plants will be expanded to provide a production of 20,000 cars a month by Jan. 1, next, including the Star and the Durant Four. The expansion of the Lansing factory will be undertaken immediately. The same will be true at Long Island City provided the land required can be obtained at what is considered a reasonable price. The engineers and contractors who built the Lansing factory now are in this city looking into the situation.

Reports that Durant Motors has acquired from the receivers of the Willys Corp. the huge factory at Elizabeth, N. J., which never was occupied, are at least premature. Durant engineers have inspected the property carefully, however, and it is understood that they have reported it would meet the needs of the company. It is not likely that Durant will acquire the Elizabeth factory unless it can be obtained at a fraction of its original cost of \$10,000,000.

Production of the Star and the Durant will be completely segregated, although it is desirable from a manufacturing point of view that they be built as near together as possible, in view of the fact that materials will come from practically the same source.

Durant Motors also announces that it has placed with the Continental Motors Corp. of Detroit, an order for 250,000 engines for use in the Star. This is one of the largest, if not the largest, single order for engines ever placed.

PREPARE FOR TOURIST BUSINESS

Minneapolis, April 1—Preparation is being made for a largely increased influx of motor tourists this year. The tourists left last year \$500,000 and this year it will be probably twice as much. The state hotel keepers have been aroused to the need of providing better accommodations this year and the Ten Thousand Lakes association of the state is abetting them in their change of attitude. The Minneapolis bureau will open this year in April instead of July 1. Welcome headquarters will be at the town house of the Minneapolis Automobile Club.

Gray Prices to Be \$490 and \$760

Touring and Coach Models Planned for Production

Schedule of 23,000 Cars for 1922— Several Dealers Already Appointed

DETROIT, April 3—Gray Motor Corp. fixed the prices on its touring car and coach this week at \$490 and \$760, respectively, and announced it would get into quantity production on its 23,000 car schedule for 1922 in May. In connection with the fixing of the prices it was announced that the car will be powered with a four-cylinder Gray engine and will have Timken axles fore and aft.

D. Henry Bonner has been named sales manager of the company. Bonner was formerly in charge of all branch production for the Ford Motor Co., and served later as assistant production manager to William S. Knudsen at the Ford main plant.

Frank L. Klingensmith, formerly Ford executive vice-president and treasurer, president of Gray, said the company has completed its financing and has withdrawn its stock from sale. The company is capitalized at \$4,000,000 and has sold \$2,600,000 in stock.

All production and assembly of the car will for the present, be at the Gray Motor plant, this city. There is a present capacity for 250 engines and 100 cars daily which will be increased in anticipation of 1923 business. Assembly plants in the New York, Boston, Philadelphia and St. Louis districts are expected to be opened before December, with others to follow in 1923.

As designed for production, the car will weigh about 1,600 pounds and will have a wheelbase of 100 inches. Artillery wood wheels have been substituted for disk as more becoming the lines of the car.

Among the dealers thus far named by the company are Albert Hirst, New York; Brown Motors Co., Boston; Louis C. Block, Philadelphia; Anderson Strauss Co., St. Louis; Charles E. Baker, Inc., Detroit; John S. Keown, Louisville, and Edward P. Wilson, Columbia, S. C.

Organization of a company personnel will be held to a minimum with Klingensmith in charge of all financial matters, F. F. Beall, former Packard vice-president, in charge of manufacturing, and Bonner in charge of sales.

MACK TRUCK SALES INCREASE

New York, April 1—Sales by Mack Trucks, Inc. are running well ahead of last year at this time. If business continues at the current rate, substantial profits are expected for the second and third quarter.

TIMKEN-DETROIT AXLE REPORT

Detroit, April 3—The balance sheet of Timken-Detroit Axle Co. as of Dec. 31 last, shows total assets of \$19,105,138.35, as compared with assets of \$21,494,864 at the end of 1920. Current assets were \$8,350,104.16 and current liabilities \$2,427,301.08. Net working capital of \$5,922,803.08 compares with \$8,762,148 a year ago. Inventories carried at \$10,932,521 have been reduced to \$7,258,281.18. Accounts payable of \$3,458,647 a year ago have been reduced to \$438,824.02, a large part of this, \$1,950,000, by substituting bank loans for the accounts.

CADILLAC RETAIL SALES

Detroit, April 3—Sales statistics founded on reports from all distributors issued by the Cadillac factory show an increase of 55 per cent in sales for the last two weeks in February over the same period in 1921, and an increase of 50 per cent for the first week in March over the 1921 week. Deliveries in the last two weeks in February by distributors exceeded the same period of 1921 by 75.8 per cent, and in the first week in March showed a gain of 39.2 per cent.

On March 11 the Chicago branch delivered and collected for 26 cars, wholesale and retail, the largest single day's delivery since the institution of the branch.

STANDARD CREDITORS' DIVIDEND

Cleveland, April 4—Federal Judge D. C. Westenhaver has given Receiver Frank A. Scott, of the Standard Parts Co., authority to pay creditors of the company a dividend of five per cent. About \$500,000 will be paid to creditors under this order. With the current payment the receivers will have paid creditors a total of 25 per cent and \$2,400,000 has been disbursed to holders of claims during the administration of Receiver Scott.

O'BANNON CORP. REORGANIZED

New York, April 3—The O'Bannon Corp. manufacturer of coated fabrics, which has been operating under a receivership for several months, has been reorganized as the O'Bannon Co. The personnel of the operating departments will remain largely the same, but the company will be under the management of the Russell Co., of Boston.

STERLING-KNIGHT BUYS PLANT

Cleveland, April 3.—After carrying on engineering and mechanical experiments for more than two years, in the course of which refinements and additions were made to the Knight motor, the Sterling-Knight Motor Car Co. last week purchased the plant of the Accurate Machine Co., in this city.

Bureau to Certify Quality of Automotive Products

Articles Which Are Approved After Tests May be Sold Under Trade Mark

CHICAGO, April 1—A Bureau of Certification has been formed here for the purpose of certifying to the quality of automobile parts and equipment made by manufacturers who are accepted for membership in the bureau.

The prospectus issued by the organization says:

"Only manufacturers who have a reputation for fair dealings with the trade and who have a reputation for turning out high grade merchandise, will be invited to join the Bureau.

"An efficiency department will be established whose duties it will be to thoroughly investigate the manufacturing plants of the member to check up their manufacturing practice, their ability to make high-grade products, the quality of material used in construction and their methods for testing and inspecting the finished article.

"It is the purpose of the Bureau to establish a laboratory which will be in charge of a competent, well known automotive engineer, for the purpose of testing when necessary the products of its members.

"Concerns whose articles have been on the market for a number of years can have their articles certified to, without such tests, but the engineering department will check up all articles from time to time, picking up such products on the open market and testing, to insure the public that the quality, workmanship, material and size specifications are being maintained.

"Comparative tests will be made of the like products manufactured by our members, to determine an efficiency standard, and such tests must show the article of the member to be the equal of or superior to, in general efficiency, any article of the like design or purpose."

An extensive advertising campaign is planned and the prospectus says that all advertising will carry the names of the member concerns. It is planned to have a trade mark which members of the Bureau may stamp upon their products and use in their individual advertising. This trade mark, the prospectus says, will be the purchaser's guarantee of the utility and quality of the article.

Temporary offices of the Bureau are at 227 So. LaSalle Street, Chicago.

The financing will include an initial fee of \$100 a member and such additional fees as may be decided upon by the membership.

Brace Predicts Sale of 2,000,000 Cars This Year

**President of N. A. D. A. Declares
Farmers Are Back in
the Market**

By W. J. BRACE, President
National Automobile Dealers' Assn.
KANSAS CITY, April 3—Automobile sales prospects are brilliant as spring opens in comparison to the condition that prevailed as the industry moved into the spring of 1921.

Have you ever tried to work out a puzzle map and have been absolutely helpless to put the whole together because some important piece was missing? Well, that has been the situation existing for the last year and a half whenever one tried to reconstruct the business and economic map of the United States. It couldn't be done because the most important element in that picture, was missing.

Who is this element? The farmer! Was he missing in 1921? He was.

Is he back in the picture this year? Most decidedly he is, in a condition greatly improved over that of 1921.

The report of the various federal reserve banks gives splendid reassurance that prices of farm commodities are seeking their rightful, higher levels. In the readjustment that began in the summer of 1920 and extended clear through to the latter months of 1921, prices of farm products were out of all proportion to their cost of production, and flagrantly out of proportion with the cost of other commodities and with city wage scales.

There has been a steady, gradual upturn. Farm prices are not yet as high as they are going, but the farmer doesn't stand in nearly so an unfavorable position as he did a year ago.

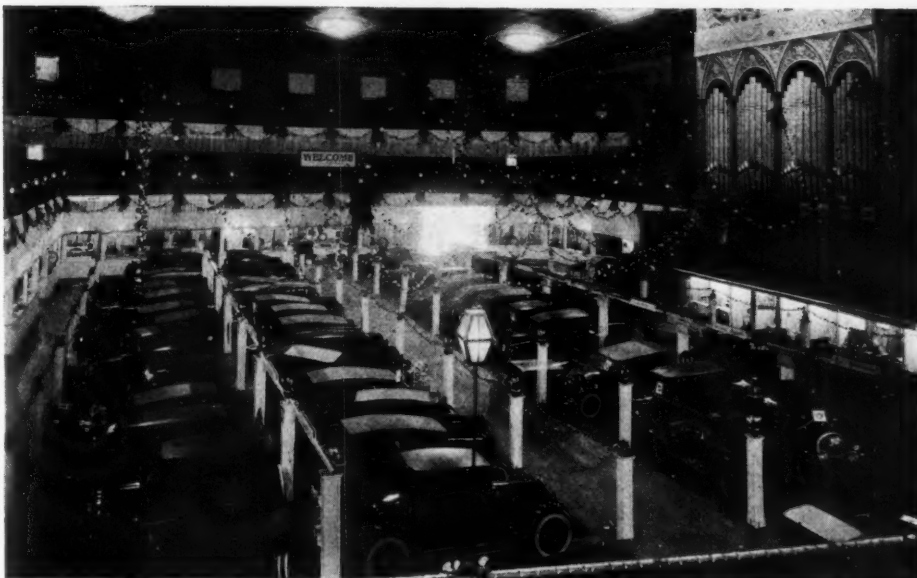
May wheat has sold as high as \$1.47, Chicago, hogs have risen to nearly \$11.50 from the \$7.00 low mark, corn is netting a little better than 80 cents a bushel to the farmer who is feeding it to his pork, and the prices of cattle have been steadily improving.

What does this mean to the automobile industry?

Farmers own approximately one third of all the motor vehicles in the country. As a class they are our best customers. Many of the motor vehicles now on the farms will have to be replaced this year, a large majority of these replacements rightfully should have been made last year but the farmer was without the money with which to do it.

But he will have the money this year and he will spend it wherever he will see a chance to increase his farm profits. The motor vehicle has been one of the greatest additions to farm life in this respect. It has enabled the farmer to get his product to his market at the earliest moment and take advantage of any break in prices that may come in his favor.

Part of Denver Automobile Show



I do not like to indulge in prophecy. It is always a thankless job and at best is beset with many influences that are apt to change results. But I feel confident in saying that if business goes on in the path that it is now taking, without interruption or without unforeseen difficulty, 1922 will see approximately 2,000,000 motor vehicles placed in the hands of owners, as against the 1,700,000 disposed of last year.

Of course this upturn in the automobile business is going to mean renewed activities in other businesses, for every industry in our country is inextricably bound up with every other industry and what helps one will help all.

The winter is over. The public mind is gaining composure. Stocks of all kind have been depleted and replacements are beginning to make their demands. The world situation is improving, slowly but surely, and people are getting their attention turned back to the business of living, of making money and of being happy. They are becoming more and more cognizant of the terrific waste of lives wealth and materials brought about by the war. So far as it is possible they want to recoup all those losses.

The better factories and the better dealers in our industry are all set for the future, confident of the outcome. We have no fears of 1922 because those of us who are set, have no fears of ourselves. Nineteen twenty two is going to be a mighty profitable year in the automobile industry for the right kind of dealers and factories.

NEW FORD FACTORY

New York, April 4—A dispatch from Southampton, England, states that representatives of Henry Ford have agreed to purchase from the city government a site for an automobile factory to cost £500,000.

Successful Show Given By 36 Dealers in Denver

Denver, Colo., April 1—The automobile show which was held here three days and four evenings last week in the Municipal Auditorium was a success. Seventy-two passenger cars were exhibited by 36 distributors and dealers and there were 46 accessory booths.

One encouraging feature was the attendance of nearly 500 dealers from the territory supplied through Denver distributors. Many of them were able to persuade friends from their own communities to attend the show. Many of the dealers reported a large number of sales made at the show and all obtained a good many prospects.

The show was given under the auspices of the Denver Automobile Trade Assn. and was managed by Henry Dawson, who also had charge of last year's event. The dealer committee assisting the manager in making the show a success consisted of D. S. Eddins, chairman; Fred S. Andrews, Myron L. Smith, James H. Naylor, Frank M. Cockran, John Graham and Fred L. Green.

REFUSES NEW CONTRACTS

Detroit, April 1—The Fisher Body Corp. reports that it has been compelled to refuse several new orders because of a shortage of manufacturing facilities. Some of the Detroit plants are working overtime while others are not yet at capacity. The average for the Fisher factory is about 95 per cent of capacity.

TRAIN LOADS OF DURANTS

Lansing April 3—The Durant Motor Car Co. of Michigan now has launched into actual quantity production. Arrangements have been made by M. B. Leahy, the Durant general sales manager, for trainload shipments to Kansas City and Cincinnati.

Used Car Problem Discussed At Texas Dealers' Meeting

**Too High Allowance on Trade-ins
Said to Have Caused
Many Failures**

WACO, TEX., April 1—Discussion of the used car problem, the trade-in business, the future outlook, a closer co-operation between dealers, methods of increasing memberships, the financial situation, and the automobile business generally, and listening to an address by Eddie Rickenbacker on the automobile business and prospects over the nation, featured the sixth annual meeting of the Texas Automobile Dealers here.

At the close of the convention, attended by some 400 dealers from all sections of the state, Corpus Christi was selected as the next place of meeting and the following officers elected for the year:

Percy Garrett, Fort Worth, President; W. A. Williamson, San Antonio, first vice-president and manager; Joe Mitchell, Waco, and E. H. McFall, Wichita Falls, vice-presidents.

Directors Named

The directors for three years named were: George Gallas, Houston; H. L. Robertson, Houston; Frank Winerrick, San Antonio; DeWitt Reed, Corpus Christi; Frank Covert, Austin; Mack Sterrett, Dallas; J. H. Sheldon, Dallas, and William Morris, Dallas.

The directors elected for two years are: C. W. Mansfield, Houston, and Rex Thompson, Austin.

The used car and the manner in which it has figured in the legitimate profits of the retailers of Texas has been a carbuncle on the neck of the automobile dealers, a disease which has caused scores of retailers to fail and a thorn which cripples many others, according to F. E. McLarty of Dallas, one of the speakers. He declared the losses, taken in the used car game formed a serious financial question for the retailers and that they must, in justice to themselves and the business as a whole, take some sensible, fair and practical methods of dealing with the matter.

Too Much for Used Cars

McLarty said that dealers are paying entirely too much for used cars on trade-ins, and that this must be remedied by establishing a custom of paying what the cars are actually worth, and allowing what they are worth, or business will continue to be hampered and probably the public made to feel not exactly right toward the retailer.

Retiring President Morris of Dallas supported the views of McLarty on the used car problem and thought the organization of automobile men in various cities should get together on the matter of handling that class of business.

Route of Pike's Peak Automobile Races



COLORADO SPRINGS, April 1—The annual automobile hill climbing races, from Colorado Springs to the top of Pike's Peak, will be held this year on Labor Day, Sept. 4, under the auspices of the Pike's Peak Auto Highway Co., Colorado Springs. F. C. Matthews is traffic manager in charge of the races this year. They will be classified the same as last year: One event for cars with a piston displacement of 183 inches or under, one event for cars with a piston displacement of over 183 inches up to 300 inches, one event for cars with a piston displacement over 300. The prize money will be the same as last year for each event. The route is 30 miles long and the maximum grade is 10½ per cent.

FEWER DEALERS IN WISCONSIN

Milwaukee, Wis., April 1—So far in 1922 only 1425 dealers' licenses have been issued by the secretary of state of Wisconsin, while last year the total registration was 2122. A year ago at this time more than 1950 had already taken out licenses. The largest number ever issued in any one year was 2167, which was in 1917, but in that year the regulations were less strict than now in regard to whom such licenses might be issued. At present the issue is confined strictly to bona fide dealers. Dealers are required to furnish certificate of agency. After being licensed, they are required to furnish monthly lists of cars sold.

REID'S RACE ENTRY RECEIVED

Indianapolis, April 1—It is announced by T. E. Myers, manager of the Indianapolis Motor Speedway race course, that the entry of Wallace Reid, motion picture star, has been received for the International 500-mile race to be held here Tuesday, May 30. Myers said he has definite information that Reid will arrive here May 4 to start training.

Ford Prices Reduced in England; U. S. Not Affected

London, March 20—(By Mail)—Price reductions ranging from £10 to £15 (normally from \$50 to \$75) on the various Ford models have been announced here. The biggest cut is on the sedan.

Detroit, April 4—The Ford Motor Co. said that the reduction of prices in England has no significance so far as the United States is concerned. It was asserted that the drop was based on the January reduction here.

MONTREAL DEALERS ELECT

Montreal, April 1—George Bergeron was elected president of the Montreal Automobile Trade Assn., Limited, at the latter's annual meeting held in the Windsor Hotel. A. M. Jaques becomes vice-president, R. G. Gilbride, treasurer, and L. M. Hart, honorary secretary, while C. S. Hoben, J. O. Linteau and Florian Leduc complete the board of directors. Adelstan Levesque was reappointed active secretary.

Dealer Is Keynote for This Year's Business, Says Reeves

Head of N. A. C. C. on Tour of Centers, Finds Production Surprisingly Large

NEW YORK, April 4—Genuine surprise at the volume of production, both of passenger cars and trucks, was expressed by Alfred Reeves, general manager of the National Automobile Chamber of Commerce, upon his return from a two weeks' trip through the factories in Michigan and Ohio.

While Reeves has been consistently conservative in his estimates of passenger car production for 1922 and believed until he started his trip that it would not greatly exceed that of 1921, he now is convinced that the total will be considerably larger. He feels no doubt that truck production will be materially increased.

"Everywhere I traveled I found a new spirit among the manufacturers and dealers," he said. "Production was increasing; dealers were writing in for cars; some factories were duplicating some of the 1920 figures by trainload shipments to the coast and elsewhere; more than 3300 additional men were added to the payrolls in Detroit in one week and in some cities there was an actual shortage of experienced automobile workers, although still a large surplus of unskilled labor.

"Notwithstanding all this, the makers are going along with a spirit of conservation and with no idea that the spring business will continue for the remainder of the year; although with every indication that the last six months would be better than the same period of 1921.

"Our surveys of the second-hand car situation, which showed what a menace it was to our industry, and which also brought out scores of different suggested plans to help in the solution of the problem, has had a fine effect.

"Dealers generally, have recognized the need for action and in a great many localities plans suitable for that locality are being put into operation, all with a view of insuring the customer getting a fair price for his used car and the dealer being able to buy it at a price that will at least enable him to get out even and possibly make a small profit.

"The elimination of the so-called 'trading bonus' which undoubtedly came as a result of price guarantees, has also materially helped the situation.

"The big keynote for this year is going to be the dealer, and that manufacturer will succeed best who spends money to back his dealer into better financing, selling and general business methods.

"I find very generally, a high appreciation of the need for backing the dealer to the extreme during this, his most important year of readjustment.

"Any plan the manufacturer contem-

plates should be predicated entirely on whether it is going to be best for his dealers. I don't believe we will ever have an opportunity again to build up dealers as we have during the past and each one lost now will cost a great deal of money to replace.

"On the other hand, the dealers must respond to the needs of the times by putting their houses in order, eliminating unnecessary expense; have courage enough to meet the new form of competition and appreciate that motor car and motor truck selling requires just as much energy and financing and good business methods to insure success, as any other line of merchandise."

Highway Transportation Demands Trained Men

BOSTON, April 3—The prediction that 4000 specially trained men will be needed in the next 10 years for service in the highway transport business was made by F. W. Fenn, secretary of the motor truck committee of the National Automobile Chamber of Commerce, in an address before the students of the Massachusetts Institute of Technology.

"The whole field of highway transport," Fenn said, "is practically virgin. It welcomes the entrance of trained men. Men of the very highest professional ability are daily turning to it; only recently a former governor entered the field.

"It is fairly certain that the next great development in this country in transportation will be therefore a national delivery service for picking up traffic at the point of origin and making delivery at the store door of the consignee. The motor truck offers the best solution of this problem in the opinion of many railroad officials."

F. W. D. CARS REPLACE ELECTRICS

Clintonville, Wis., April 1—The Manhattan City & Interurban Railway Co. of Manhattan, Kan., has scrapped its heavy electric cars and equipment and has replaced them with four F. W. D. railway cars manufactured by the Four Wheel Drive Auto Co. The chassis for these cars are the same as those used in the standard F. W. D. three-ton truck with the exception of changes necessary to fit the tracks for rail service. The cars are operating over the rails which were used by the electric cars and on the same schedules.

SALES INCREASING PROGRESSIVELY

Marysville, Mich., April 1—C. H. Wills & Co., manufacturer of the Wills Sainte Claire car, announces that January business was 50 per cent over the November and December average; February was 50 per cent over January; the first 20 days of March showed an increase of 60 per cent over February, and April orders already booked give a definite increase in business of 100 per cent over March.

Group Organization Plan of M. A. M. A. Abandoned

Members Notified of Action—Directors Make No Statement as to Reasons

NEW YORK, April 4—Directors of the Motor and Accessory Manufacturers Assn. have decided on the ground of policy and expediency to abandon the group plan of organization for manufacturers making products of the same general character. Notices have been sent to members informing them of the action taken.

Considerable progress had been made in developing this form of organization, and associations whose members produced springs, sheet metal, wood wheels, and headlights had been taken into the M.A.M.A. as groups. The latest to affiliate were the makers of headlights, who acted during the Chicago show, and the Automotive Wood Wheel Manufacturers Assn., who voted during the New York show to dissolve their organization.

After the wheel makers came in, Hargrave A. Long, of Chicago, who had been secretary and treasurer of their association, was appointed manager of the industrial group department of the M.A.M.A. He has now been relieved of these duties and will return to Chicago.

No information is available as to whether the associations which were dissolved to continue the same general activities with the M.A.M.A. will be reorganized. No statement has been made by the directors of the M.A.M.A., as to the motives which prompted their decision to abandon the group plan. It is understood, however, that it was felt it would prove unwieldy. The nebulous state of the federal law in relation to trade association activities also is believed to have had some bearing on the action.

GARAGE OWNERS ELECT OFFICERS

Brooklyn, N. Y., April 3—The 1922 officers of the Brooklyn Garage Owners' Board of Trade are: F. M. Powell, president; F. M. Kestler, George F. Speltz and P. E. Slater, vice-presidents; Fred M. Smith, secretary; F. H. Russell, treasurer; John G. Snyder, counsel. Smith is also secretary of the Automotive Service Assn., of Brooklyn. The association has about 100 members and plans are under way to increase the membership among the better classes of garages.

FACTORY LOCATION DECIDED

Fox Lake, Wis., April 3—The Six-Wheeled Truck Co. of Fox Lake, Wis., has decided to build its proposed new factory in Fox Lake instead of in Fond du Lac, Wis., where local capital attempted to secure a relocation.

DuPont's Active Control of General Motors Begins

**Marked by Selection of Former Ford
Man as Chevrolet
Manager**

DETROIT, April 4—The election of W. S. Knudsen as vice-president in charge of operations of the Chevrolet Motor Co. and the assignment of K. W. Zimmerschied, although continuing as president, to advisory duties connected with the office of Pierre S. duPont, president of the General Motors Corp., may be defined in a measure as ushering in duPont as the real active head of the great motors combination.

Since duPont became president of General Motors after the retirement of W. O. Durant, he has confined himself more to a study of the industry, the company's units and possibilities of development than to the active direction of its forces. Practically a stranger to automotive manufacture, he has for more than a year been acquainting himself with the men in the industry and the factors that have brought it to its present strength. The realignment of Chevrolet is credited directly to duPont.

Knudsen, former production manager at the Ford Motor Co., was brought into General Motors two weeks ago as assistant to Vice-President C. S. Mott, chairman of the advisory staff of the company. In those two weeks he made a survey of several General Motors units, including the Tarrytown plant of Chevrolet and made certain recommendations. His appointment as operations head of Chevrolet came after these recommendations.

It has been no secret that Chevrolet has been unable to get into production on a scale that, coupled with present prices, would make the unit a profit producer. With Knudsen's experience in Ford manufacture, and it is said he is one of the few Ford men who ever resigned from that company, General Motors plans to gain the utmost efficiency in the production of its low priced car.

Since the duPont regime in General Motors began the Chevrolet small car has been steadily built up mechanically to give the utmost value at the price. It is now a question of making the car, with its improved units, at a production rate that will justify prices. The company will concentrate all its efforts on the manufacture of the small line.

K. T. Keller will remain as a vice-president of Chevrolet and manager of manufacturing, according to the duPont announcement, and Colin Campbell will continue as vice-president of the several sales companies and general sales manager of Chevrolet.

In connection with the changes, it is recalled at General Motors headquarters that Zimmerschied will be resuming

work of a nature similar to that performed by him under Durant. The resignation of Durant from General Motors and Chevrolet resulted in Zimmerschied being elevated to the presidency of Chevrolet. His duties were multiplied through the resignation of Chevrolet officers to join Durant in his new enterprise. Now all the burden of the production end will be shifted to Knudsen.

Truck Business Gaining; Lighter Sizes in Favor

Detroit, April 4—The truck industry is making steady strides toward recovery and is coming back principally through the medium of the lighter vehicles. Every month this year has seen increased releases to the parts makers, March business doubling February, and April releases already indicated will double March.

Most of the releases are for parts for one and a half ton vehicles. There is considerable business in two to three ton sizes but after three the business is light. For the present the heavy duty truck has entirely given way to its lighter brethren.

Explanations for the buying of lighter trucks give it as an indication of a return of general business, but on a lighter basis than formerly and requiring more frequent deliveries of smaller shipments. It is also declared that many truck buyers unable to finance the purchase of a heavy truck now are using the lighter trucks temporarily.

LIGHT TRUCKS IN DEMAND

Milwaukee, Wis., April 4—Encouragement is found daily in reports from manufacturers of passenger cars and the parts industry as well, which indicate that the improvement which set in 30 to 40 days ago is going forward. A little better feeling also has been injected into the motor truck industry by something akin to a renewal of demand, although this is yet far from satisfactory. So far the principal call has been for the lighter types, with sales of the three-fourths ton capacity predominating. The manufacture of tractors has not yet been resumed on anything like real scale, but prospects are growing better as the surplus stocks in hands of makers and jobbers are steadily being wiped out by the much better movement of these machines into farmers' hands.

SEIBERLING TIRE WEEK

Akron, O., April 3—The new Seiberling cord tire manufactured by Frank A. Seiberling, founder and former president of Goodyear, and now president of the Seiberling Rubber Co., of Akron, Barberton and New Castle, makes its formal bow to the motoring public during the week of April 3. Over 1500 tire dealers throughout the United States will display the new tire simultaneously, all using the same window display scheme.

Appreciation Day Marks Quincy Automobile Show

**Dealers Impress Upon Bankers and
Others Importance of Their
Industry**

QUINCY, Ill., April 1—The fourth annual show under the auspices of the Quincy Automobile Trades Assn. opened Wednesday in the State Armory. The display of cars and accessories was limited only by the floor space and even then dealers were compelled to make their exhibits as compact as possible so that all applicants could be given space.

A special effort was made this year to establish an Appreciation Day. This was on Thursday, the second day of the show, and the preparation for it had been going on for several weeks. Members of the Automobile Trade Assn. had appeared before other trade bodies in the city and a special folder was compiled and printed showing the importance of the automotive vehicle and the automotive business to Quincy.

Sales Encouraging

On Wednesday the officers of the Automotive Trade Assn. and the out of town visitors were guests at the Lions Club with a special program arranged for this occasion. In the evening the annual banquet of the Automotive Trade Assn. was held and representatives of all other Quincy trade associations and from each bank in the city were present. An effort was made to present to all in attendance the importance of the automotive business.

A. W. Nesta, president of the Automotive Trade Assn., spoke on transportation and then turned the program over to J. W. Hart, who was toastmaster. E. E. Peake, manager of the Kansas City show, was the chief speaker of the evening. He brought out the importance of this new form of transportation to any trade community. Other speakers were Clyde Jennings, managing editor of Motor AGE, and A. V. Commings, of the Chilton publication.

The attendance at the show and the number of sales reported was decidedly encouraging.

COATS DELIVERIES SOON

Chicago, April 1—The Coats Steam Car Co. announces that production of the Stewart-Coats steam car is under way at the plant of the Stewart Motor Car Co., Bowling Green, Ohio, and that deliveries are expected to be made in April. The touring car is priced at \$1085.

The company also announces the organizing of the Canadian Steam Motors, financed by Canadian capital, to handle Coats steam cars for the western part of Canada. Headquarters of this company are at Victoria, B. C.

Tire Dealers Fight Direct Sales by Manufacturers

President of National Assn. Says Makers Largely Supply Consumers

AKRON, O., April 4—A nation-wide campaign will be conducted by the National Tire Dealers' Assn. in an effort to have American tire manufacturers stop selling direct to the consumer and agree to sell only through recognized tire dealers, according to an announcement of A. F. Valentine, of Cleveland, president of the National Tire Dealers' Assn., made before northeastern Ohio tire dealers at a mass meeting in Akron.

"American tire dealers are demanding a show down from American rubber manufacturers; we want to know whether they are going to sell their future products direct to the consumer or through legitimate tire dealers," said Valentine.

"Our national organization already has called the turn on several companies, and as a result the Goodyear, United States and Kelly-Springfield Tire companies have now agreed to sell through none but recognized tire dealers. I have no doubt that many of the other big companies will adopt the same policy without compelling us to make an aggressive fight for it."

Valentine claims that a recent survey made in Cleveland shows that tire sales in Cleveland annually amount to nearly \$7,000,000 and that nearly 75 per cent of these sales are swallowed up by the tire manufacturers by means of direct sales to consumer through their own road salesmen and branch organizations.

"Never has the position of the tire dealer been so recarious as it is today," Valentine said. "It is a fact that heretofore the big rubber companies have pretended to give the dealers certain territories and have then loaded them up with stock and turned right around and left them high and dry by selling under them directly from the factory to consumer."

"There has been some talk of tire price increases. It appears to me that this increase talk has been sent broadcast principally to induce tire dealers to load up with big tire stocks again. I certainly would not recommend tire dealers to do so or to fall for this talk of the rubber companies, for I doubt if they intend to increase prices very soon."

HAYNES PRODUCTION INCREASES

Kokomo, Ind., April 1—According to figures given out by Alton G. Selberling, vice president and general manager of the Haynes Automobile Co., production of Haynes cars has increased 200 per cent since Jan. 1. The March production is said to be over 25 per cent over the production for the same month last year.

Ford Wants Battleship Metal for Cars and Tractors

DETROIT, April 3—"If satisfactory arrangements can be made it may not be long before metal that was once a part of an American battleship will be running around in the form of a Ford car or tractor," says a statement by the Ford Motor Co. "The quality of the metal in war vessels will permit this. It can be remelted, carefully tested as to its suitability for mixing with other quantities of molten metal and poured into cylinder blocks and various castings. This ore that was mined, converted into metal and used in ship construction at great expense will not be an entire loss. Some, at least, of the taxpayer's money will be returned to the Treasury, and, in addition, useful tractors built."

ALEMITE CO. IN NEW PLANT

Chicago, April 3—The Bassick Mfg. Co., manufacturers of the Alemite Lubricant system for automobiles, has moved to its new plant at 2630 N. Crawford avenue. The new plant has 70,000 square feet of floor space. It is one story high and of saw tooth construction and so designed that artificial light will rarely be necessary. The ground area covers about 160,000 square feet which allows for expansion.

The officials of the company state that there is an increased demand for their product and that 300 automobile dealers are using their equipment. Nearly 1,500,000 cars are said to have been equipped with Alemite system. The company has about 10,000 dealers throughout the United States.

NEW SERVICE ASSOCIATION ELECTS

Philadelphia, April 4—Officers were elected here by the Automotive Service Assn., which held a dinner in the quarters of the Philadelphia Automobile Trade Assn. The election resulted as follows: President, J. B. Dickson, superintendent of service, the Neel-Cadillac Co.; first vice-president, Clifford G. Culver, service manager, the Packard Motor Car Co., of Philadelphia; second vice-president, John J. Reinle; service manager, the Autocar Sales and Service Co.; secretary, Charles C. Bulkeley, executive secretary of the Philadelphia Automobile Trade Assn.; treasurer, Howard Miller, of the Peerless agency.

RECEIVER FOR HALLADAY CORP.

Newark, O., April 3—A receiver has been appointed for the Halladay Motors Corp., which is capitalized at \$400,000. The proceedings were instituted by the Barber Asphalt Paving Co., of Pennsylvania. The motors company admitted its obligations and joined in the petition for the appointment of a receiver. Edward Kible, an attorney, was appointed and his bond was fixed at \$30,000.

New Continuous Dealer Contract Adopted by Nash

Does Away With Annual Renewal And Gives Protection Against Price Reductions

KENOSHA, Wis., April 5—The Nash Motors Co. has announced a new form of dealer contract which has two important features.

The contract once written is continuous in the sense that it does not have to be rewritten each year, but holds good as long as the business relationship it cements is mutually satisfactory to the factory and the dealer.

The thought of The Nash Motors Co. behind this clause is said to be the wish to have the Nash dealer feel the permanency of his relationship with the factory and that he may retain the franchise as long as he continues to give the Nash company satisfactory representation. The dealer may thus devote all his energies to building his business along lasting and permanent lines, knowing that he will not have to face the uncertainty which always accompanies the signing of new contracts on a yearly basis.

The second important feature of the new contract is that the dealer is given protection on all current models of new Nash cars that he may have on hand and which may have been shipped him from the factory during a period of six months immediately prior to the announcement of any price reduction by the factory.

TO BID FOR AUTO-LITE PLANT

Toledo, April 1—Clement O. Miniger, one of the receivers for the Willys Corp., will make an offer to the federal court for the Electric Auto-Lite division with plants here and at Fostoria. The amount of the bid has not been determined but the proposal now is being considered by committees representing bank and merchandise creditors.

Miniger, who was a vice-president of the Willys Corp. and general manager of the Electric Auto-Lite plant, probably will have several associates in the deal, but he declines to name them. Several weeks must elapse before the negotiations can be completed, as advertisement for 30 days is required under the Ohio law. Miniger now is a director in two or three companies which are subsidiaries of Durant Motors, Inc.

OPPOSES SIDEWALK GAS PUMPS

Buffalo, N. Y., April 1—A court action has been begun here to determine whether the city has a legal right to drive gasoline pumps from curbs as is being advocated by Mayor Frank X. Schwab. The suit which seeks to have the curb pumps removed as "illegal obstructions" was brought by John Kahabka, who owns ten "drive in" filling stations.

Statute Limiting Repair Bills No Bar to Civil Suit

Court Rules Repairman Doing Work Without Written Authority May Sue

NEW HAVEN, Conn., April 3—The new Connecticut statute making it a criminal offense for an automotive repair man to run up a bill of more than \$50 on a job, without written authorization of the car owner, has no application in civil cases, according to an opinion handed down by Judge John R. Booth, in the civil side of the common pleas court here. The ruling was made on a demurrer entered in the suit of Jerry Cozzolino of the Cozzolino Garage, against James Puzzone, a customer. The case has been attracting wide attention in automotive circles of the state, because of the wide discussion and varying opinions relative to the new law, enacted by the last legislature. Judge Booth's ruling is considered to constitute a precedent.

Although the question of damages will not be disposed of until the issues are tried out, the principle involved is settled by the ruling on the demurrer. As far as is known, this is the first application of court action on the question since the legislature enacted the law. The subject has proved of vital importance to all automobile owners, garage owners and repairmen.

Puzzone sent three automobiles to the Cozzolino garage and the bill for repairs amounted to \$324.11. The owner refused to pay in excess of \$50, contending that the state law forbids making repairs in excess of that amount without a written order, and that no such order had been given. The repairman then brought suit to the common pleas court. There the issues were raised several times and finally the plaintiff entered a demurrer to the defense, claiming that the criminal law is not a bar to recovery in a civil action. The contention is sustained in Judge Booth's ruling.

The statute in question is as follows:

"Whenever any repairman or automobile mechanic shall receive any motor vehicle for the purpose of making repairs, he shall, before his charges upon the same shall exceed \$50 obtain from the owner or possessor of such vehicle, a written authority for any expenditure in excess of said sum. Any person who shall violate any provision of this section shall be fined not more than \$50 for the first offense and for any subsequent offense not more than \$100, or imprisonment not more than six months, or both."

SALESMEN PROTEST AGAINST TAX

New Orleans, April 3—The interpretation of the new Louisiana law which levies a tax of \$5 on all persons who drive automobiles for profit, has brought a

storm of protest from chauffeurs and automobile salesmen. Both salesmen who use another person's car for demonstration purposes and chauffeurs who drive cars other than their own must not only pay the \$5 state tax, but must pay \$2.25 into the city treasury for the privilege of operating motor vehicles on the streets, and must undergo a physical examination, give a full history of their occupation for two years back, must state whether or not they have ever been arrested for violation of traffic ordinances, bring in two responsible persons as witnesses and swear to the statements.

At a mass meeting held by the chauffeurs and others who drive automobiles not their own, including salesmen and mechanics, a strong protest was made against payment of the state tax. W. B. Parkhouse, president of the New Orleans Automobile Dealers' Assn., was present and made an address endorsing the protest.

Progress in Equipment Standardization by A. E. A.

Chicago, April 1—The Standardization Committee of the Automotive Equipment Association met last week at Cleveland and adopted recommendations concerning 109 items of automotive equipment. The recommendations have to do with packing, marking and the elimination of sizes and types. The purpose of the committee is to endeavor to establish uniform practices among manufacturers as to sizes and types and methods of packing and marking. The elimination of unnecessary sizes and types is expected to result in considerable saving to makers and dealers.

The committee is now at work on the preparation of a handbook in which the recommendations it has adopted will be listed. The book also will contain extracts from the recommendations of the Society of Automotive Engineers. It will be a loose leaf book and additional sheets will be published as new recommendations are made.

TO MAKE CORRUGATED TUBE

New York, April 4—The Corrugated Rubber Corp. has been organized to manufacture the No Ceem corrugated inner tube, a product which is described as being "moulded in one perfect ring oval in cross section, without splices, seams or creases." The tube is corrugated on the outside to facilitate circulation of air between the tube and shoe and to prevent sticking. Headquarters of the company will be in New York and a plant will be erected at Poughkeepsie.

The company is capitalized at \$1,500,000. W. L. Fairchild, inventor of the process by which the tube will be made, will be vice president. The Edward A. Cassidy Co., manufacturers' sales agent located in New York, will distribute the product.

New England Buys Heavily At Boston Automobile Show

\$2,000,000 Is Estimated As Representing Sales at Eastern Show

BOSTON, April 1—New England woke up and during the last four days of the motor show placed orders for cars that have been estimated by some of the dealers to represent about 1500 sales wholesale and retail, cash value \$2,000,000. And then the people kept on buying the present week in large numbers.

The dealers got an amazing surprise. The opening on Saturday drew the big free ticket crowd. Monday and Tuesday the attendance was not very large. Wednesday they began to flock in from all over New England with money in their pockets and they picked out the cars. From that time on there was no question about the sales. And attendance was nearly 200,000.

They bought big and little cars. Studebaker came out with an advertisement saying that it had sold 115 cars in the Greater Boston district, representing a value of \$209,670. That set everyone talking. Dodge did not report its sales but Mr. Henshaw said he was leaving for Detroit with orders from Boston alone for more than 150 cars and to ask them to ship without limit until future notification. Cadillac issued a statement that it sold 55 new cars at retail worth \$250,478, and used cars for \$46,000, or \$296,000 worth of business. Marmon sold 16 new and eight used cars at the show and five new cars within two days afterward. Packard sold some 40 Single Sixes and seven Twin Sixes, and a number of used cars. Velie sold more than 100; Nash did a bigger business show week than the entire month of March a year ago; Hudson and Essex went big, so did Buick. Pierce-Arrow had more than a dozen sales closed before the show ended. Maxwell and Chalmers had 70 show sales and more than that number this week. Gardner went over the 100 mark. Cars in the Jordan, Lexington, Haynes and that class all report a very good business. In fact cars that have been on the market and were advertised for the past few years had no trouble in sales, and new cars like Rickenbacker and Earl went over very well also. The thing that impressed the dealers and salesmen was the way people looked over cars, then went off to make comparisons and came back again to buy, without making any evasions for going away.

MILWAUKEE SALES GOOD

Milwaukee, Wis., April 1—It is not uncommon among Milwaukee dealers to be able to report that March run anywhere from 35 to 65 per cent in excess of the same month in 1921.

IN THE RETAIL FIELD

Springfield Automotive Equipment Co. has opened a store in Springfield, Mass., as distributors and jobbers, handling rims, rim parts, piston rings, Red Seal batteries, Morgan products, etc.

Leahan's Culp Plan Store, Ware, Mass., has opened a branch in Springfield, the first of a chain of branch stores in Western and Central Massachusetts, for the sale of tires and accessories.

J. J. Sheehan, formerly with the Bigelow-Dowse Co., and later with the Fisk Rubber Co., has been appointed sales manager for L. L. Bousquet, wholesale parts dealer, Springfield, Mass.

George Barre, formerly with Manley Bros., Brattleboro, Mass., has been made head of the new service department of the Hudson-Essex Garage, Greenfield, Mass.

Mack Motor Truck Co., Springfield, Mass., has moved into a much larger building, and will start an intensified drive for business. Better facilities are afforded for the showing and storage of trucks, and the parts department is doubled in size.

Louis F. Britton has been appointed sub-dealer in Westfield, Mass., for the Springfield Durant Co., and will offer Durant and Star cars in his district.

Booklet on "Shop Profits" Being Prepared by A. E. A.

New Campaign to Follow "Ask 'Em to Buy,"—350 Meetings Held, 30,000 Attend

CHICAGO, April 1—The Automotive Equipment Association has held 350 meetings of automobile dealers in connection with its merchandising campaign which began last summer. At the majority of these meetings the film, "Ask 'Em to Buy," was shown. The total attendance was 30,000.

The campaign will be continued along the present lines up the middle of June, according to Ray W. Sherman, merchandising director. Plans are being prepared for a more extensive campaign thereafter.

The theme of the new campaign will be "Shop Profits," and a booklet is being prepared by Sherman which will tell dealers and shop operators how to make profits out of their repair and maintenance business. A motion picture illustrating this phase of the work probably will be prepared.

Some of the subjects that will be treated in the new booklet will be: "Equipment," "Keeping Books," "Card Records," "Checking Losses," "Collections," and "Flat Rates."

SHULER COMPANY REORGANIZED

Louisville, April 3—Following a reorganization of the Shuler Axle Mfg. Co., which was announced after the company had been through bankruptcy proceedings, W. F. Robertson of the Robertson Steel & Iron Co. of Cincinnati, was named president of the reorganized company. W. H. May, manager of the National Casket Co. for many years, was named as secretary and treasurer. Frank A. Shuler will continue to act as general

Fred Wilson, sales manager of the Stutz Motor Car Company of America, Inc., of Indianapolis, Ind., has announced the appointment of the Stutz Chicago Co. as distributors of Stutz Motor cars for the Chicago district. The new organization will be under the management of A. S. Johnson, who for a number of years has been identified with the Stutz in that territory.

R. D. Pickford has purchased the Falconer Street Garage at Jamestown, N. Y.

Hood Motor Co., Ottumwa, Iowa, has been sold to D. B. Davis, manager of the Davis Auto Co., who will establish the Cadillac agency in this territory. The Davis company controls the Buick agency.

N. B. Reisinger, who has traveled the Milwaukee territory in a wholesale and retail capacity for many years, has been appointed district sales supervisor for Earl Motors, Inc., in this territory.

Harold D. Morgan, who formerly traveled out of Cincinnati in a wholesale capacity for a Cincinnati distributor, has just been appointed district sales supervisor for Earl Motors, Inc., with headquarters at Cincinnati, O.

A. B. Walker, who has been active in the automobile industry for some ten years, has been appointed district sales supervisor for Earl Motors, Inc., in the Kansas City territory.

manager. The majority of the department heads who have been with the company will be retained, it was announced.

A settlement with its creditors was made and the company will continue to manufacture front axles for motor trucks, trailers and tractors. All of the assets of the old company have been taken over and an additional working capital of \$150,000 has been raised.

GOOD SHOW AT SPARTANBURG

Spartanburg, S. C., April 1—Automobile dealers who participated in the automobile show, one of the best features of the Piedmont Exposition held here March 18-25, are pleased with results. At least a dozen cars were sold to exposition visitors and dozens of prospects lined up. A quarter section of the Billy Sunday Tabernacle, which was used as the exposition building, was set apart for the automobile show.

NEW TRANSPORT TRUCK LINE

Mt. Pleasant, Mich., April 3—The Transport Truck Co. has a new line of trucks ready for distribution to dealers. There is a new Rapid Transport of one-ton capacity for high speed and heavier models which differ from the previous line in capacity and are considerably lower in price. The following table shows the old and new models, with prices:

New Models	
Model 15, 1-ton.....	\$1295
Model 25, 1½-ton.....	1495
Model 35, 2-ton.....	1885
Model 55, 3-ton.....	2385
Model 60, 3½-ton.....	2585
Model 75, 5-ton.....	3485
Old Models	
Model 20, 1-ton.....	\$1395
Model 30, 1½-ton.....	1995
Model 50, 2½-ton.....	2785
Model 70, 3½-ton.....	3885

The rear axle of the Model 15 is of bevel gear type. On the former line, all models had internal gear axles. The heavier models still retain this form of final drive.

Slight Improvement In Retail Sales in Texas

Dealers Believe Orders Will Increase With Seasonal Changes; Outlook Good

DALLAS, Tex., April 1—The retail automobile business for March, so far as Dallas dealers are concerned, was as good as that for January or March or for the three last months of the old year. The sales were not decreasing and the outlook was said to be bright. The actual sales and deliveries for the month were said to be slightly above those of February, partly because of the influence of the recent spring show. There has been a wonderful increase in the desire to possess new cars on the trade-in basis, the Dallas dealers report, and this was probably stimulated by the recent exhibit of new models.

The truck business in Dallas was about up to the previous months. The tire business and the accessory business showed some improvement. The tractor and trailer trade was rather slow, although there were some tractors moving to the farming belts in the Panhandle and the rice sections of Southeast Texas.

Fort Worth Dealers reported business some fifteen per cent better than the last month. Waco dealers said business was holding its own, Houston dealers could vouch for slight increases in some lines and Galveston and Beaumont retailers said their business was about as usual.

I. H. C. RETURNS TO KENTUCKY

Louisville, April 1—The return of the International Harvester Company to Kentucky will be marked by the opening of bids on the new office and warehouse building to be erected. The Harvester company moved its Louisville plant to New Albany, Ind., about 11 years ago, following the enactment by the Kentucky Legislature of several anti-trust laws. Since then, however, the laws have been modified or repealed, and the officials of the company were induced to bring the plant back to Louisville. J. L. Gardner, general manager of the New Albany plant, said that the cost of the building was uncertain.

13 DEALERS' MEETINGS IN INDIANA

Chicago, April 1—Thirteen meetings of automobile dealers were held in Indiana in February and March by the Automotive Equipment Assn., at all of which the film, "Ask 'Em to Buy," was shown. The total attendance was 925. Meetings were held in the following cities: Indianapolis, Fort Wayne, Evansville, Terre Haute, South Bend, LaFayette, Elkhart, Richmond, Columbus, Muncie, Kokomo, Logansport and Gary.

BUSINESS NOTES

Overland Sales Co., Emporia, Kan., has changed its name to the J. R. McClaskey Motor Co.

Maryland Battery Service, Inc., Philadelphia, has added radiophones to its line.

United Auto Stores, Inc., Philadelphia, Bankrupt, has been granted another stay of sale of assets.

National Association of Farm Equipment Manufacturers, Chicago, has moved its offices.

Gray Bus Line Corp., Bridgeport, Conn., has been incorporated.

American Automobile Protective Co., Hartford, Conn., an insurance company, has been incorporated.

W. E. W. Motor Corp., Philadelphia, which merchandises Durant cars in this territory, has added seventeen dealers in the territory.

St. Paul Cadillac Co. has been incorporated for \$50,000.

Safety Device Mfg. Co., St. Paul, is incorporated at \$75,000.

Stevens Overland Co. has been moved from Minneapolis to Sioux Falls, S. D.

Moon Motor Car Co. has declared a dividend of one and three-quarters per cent on preferred stock.

C. Harold Wills, president of the C. H. Wills Co., has been named a director of the new Dominion Alloy Steel Co., Canada.

Hatfield Bros. Co., Sedgwick, Kan., have moved their executive offices from Peoria, Ill., to Sedgwick.

Starkweather-Snook Corp., Moline, Ill., has increased its capital stock from \$100,000 to \$200,000.

Ewing Bolt & Screw Co., Detroit, has acquired the plant of the Detroit Machine Co. and new capital is being provided for the development of both companies. Under the plans the Detroit Machine will build a new plant in the vicinity of the Ford River Rouge plant on property owned by the Ewing company.

Federal Motor Truck Co. announces the establishment of a factory branch at San Francisco, with a completely equipped sales and maintenance plant. J. H. Hartzell is vice-president of the local operating company.

Edward Danner, former president of the insolvent Pan-American Motors, Decatur, Ill., and a receiver of the company, has been granted court permission to sell 30 cars inventoried at \$1,000 for \$630 each to the Woodbridge Co., Boston. The car was designed to sell to the trade for \$2,000. It is now a car without a home and receivers represented to the court that it is difficult to get buyers for a machine in this predicament.

Hurley Motor Co., Philadelphia, distributor of Reo cars, gave a luncheon at the Hotel Lorraine to about 100 Reo dealers from territory in eastern Pennsylvania, southern New Jersey and Delaware, the occasion being a "get-together" meeting in connection with the official opening of the Flint Building, the new home of the Reo in this city. Scott Hurley, president of the company, presided.

Manhattan Oil Products Co., a \$4,000,000 corporation of Minneapolis, has gone into the hands of receivers, F. N. Dickson and Charles T. Kennedy of St. Paul.

George H. Hannum, president and general manager of the Oakland Motor Car Co., announces a new direct factory branch at San Francisco. The California Oakland Motor Car Co., which has been made a branch in San Francisco, was formerly simply a distributor of the Oakland Motor Car Co.

Bearings Service Co., Detroit, has opened its second branch in Canada, selecting Winnipeg, Man., as its distributing point for the western section of the Dominion.

James D. Cathey, Inc., New Orleans, has increased its capital stock from \$75,000 to \$150,000, in anticipation of greater business when the company takes over the Lincoln in connection with the Ford agency. Cathey has seven sub-agents in New Orleans, who will also handle the Lincoln.

Barton Motors Co., New Orleans, has filed a voluntary petition in bankruptcy. Assets were given at \$76,625, while liabilities were placed at \$98,024.

M. T. McGoldrick and A. L. Sanderson have organized the McGoldrick-Sanderson Co., with salesroom at Spokane, for the distribution of Oldfield tires and tubes, Firestone truck tires and Sewell cushion wheels for trucks and day and night truck, tire and wheel service.

Fort Dodge Dealers Adopt National Used Car Plan

Fort Dodge, Ia., April 1—At a recent meeting of the Fort Dodge Auto Dealers' Assn. a resolution was adopted whereby the National Used Car Market Report will be used by all members as a basis for trade-ins.

This has been long contemplated by the dealers here, but has never before been given a trial. It has been in force now for only three weeks, but dealers are already reporting that it has saved them money. An effort will be made to secure the co-operation of the sub-dealers out of Fort Dodge by the adoption of the same plan.

C. B. Pilcher, secretary of the dealers' association, reports that spring business here is much ahead of last year and the outlook for 1922 is very bright. Those connected with the automobile industry, in this section, look for a good business all year.

AWARDED \$250,000 ROYALTIES

Minneapolis, April 3—R. B. Hartsough of Minneapolis has been awarded more than \$250,000 in back royalties and interest on the Happy Farmer tractor, in a suit begun in 1919 in the Federal Court for western Wisconsin and carried through to the Circuit Court of Appeals

for the Seventh district, sitting in Chicago. The suit was brought against Albert Hirschheimer of La Crosse, and others.

Hartsough designed the tractor and built in small quantities prior to 1915, when he entered into agreement with the defendant whereby the latter received the manufacturing privilege and was to pay Hartsough on the basis of three per cent on the retail selling price of each machine. It is alleged Hartsough was induced in 1916 to cancel his contract, following which Hirschheimer reorganized the company and resumed manufacture as the La Crosse Tractor Co. The contract is restored and the cancellation set aside.

BATTERY PRODUCTION INCREASING

Ft. Worth, Tex., April 1—From an output of two batteries a day with a payroll of but two men in 1918 to an output of more than 100 batteries a day with a working force in the shop of 50 men, is the history of the Standard Battery Manufacturing Co. of this city. Alda F. Hawkins, general manager, said the plant had been increased to a capacity of more than 200 a day and that other increases are contemplated. The business of the concern in 1921 was \$260,000. This year it is expected it will amount to \$375,000.

Plans Made to Finance H. J. Walker Co. By Banks

New Bond Issue at Lower Rate and Preferred Stock Issue Proposed

CLEVELAND, April 1—The refinancing of the H. J. Walker Co., maker of automobile engines, which has been announced here, is one of a number of contemplated steps to be taken by banking and financing interests of this city to provide additional capital for half a dozen Cleveland companies that are making automobile parts and accessories, according to well defined reports.

With inventories worked down and other adjustments made, some of the companies find that the financial surgical operation was rather rough, and that it left them lean and lank.

The plan for the refinancing of the Walker Co., which supplies engines for the Grant company, and others, was disclosed in letters that were mailed to stockholders.

The notices that were sent to the stockholders propose that the \$600,000 bond issue that is due in 1925 and which carries 8 per cent interest should be exchanged for 10 years seven per cent bonds that will fall due in 1932. The exchange would save the company 1 per cent in interest and in the ten years would amount to approximately \$60,000.

There is a floating indebtedness of \$350,000 and this will be taken care of by a new issue of \$350,000 of 7 per cent cumulative preferred from Jan. 1, 1923. This issue is to be taken at par by the creditors for their claims.

When the creditors do this, a syndicate of bankers and financiers that include some of the best known men in this city will step in and provide the company working capital by purchasing common stock of the company to the extent of \$300,000.

Under such a plan as this the company will have no obligation of a pressing nature, and its obligations will be limited to the funded debt, and with the capital provided, it is felt it will have ample opportunity to develop its business.

LOS ANGELES "OPEN ROAD WEEK"

Los Angeles, April 1—The second annual "Call of the Open Road Week" will be observed here the first week in May. Plans now are being laid to make this year far surpass last. These include the decoration of the motor car sales rooms appropriate to the occasion, parades, driving contests, extensive newspaper and billboard advertising and other forms of publicity. There will be no automobile show in Los Angeles this year and every effort will be combined for open road week. The committee in charge of the event for the Motor Car Dealers association is composed of Harry A. Lord, W. D. Wright and Byron C. Foy.

CONCERNING MEN YOU KNOW

Chain Belt Co., Milwaukee, Wis., has announced the appointment of G. F. Sherratt as manager of the Pittsburgh office. Sherratt will be in charge of all of the company's chain and engineering business in the Pittsburgh territory and is equipped to render engineering service on power transmitting and material handling problems.

Robert W. Martland, secretary-manager of the California Automobile Trade Assn., has returned from an extensive tour of the state. He reports that the outlook for the automobile business in California is very bright.

Marks Ramsey, who for four years has been with the Goodyear Tire & Rubber Co. in New Orleans, Lake Charles, La., and Atlanta, has severed his connection with the firm and will go with the Sieberling Rubber Co.

M. B. Leahy has been appointed general manager of passenger cars for all the Durant companies. He will be in charge of sales for the Long Island City, Lansing, Muncie, Oakland and Toronto plants.

Charles A. Neville, sales manager of the Hinkley Motors, Inc., Detroit, announces the addition to the company's organization of Paul Webb as sales promotion manager.

C. C. Hildebrand, 10 years as manager of the Minneapolis branch of the Ford Motor Co., has resigned to take up his residence at Hollywood, Cal., where his family has been this winter. Upon his departure the employees gave him a platinum set diamond ring and the dealers presented him with a Judkins closed body Lincoln car. He was also guest at a dinner given by the roadmen.

George Smith, assistant manager of the Buffalo Ford plant, died at his home here after a brief illness. Death was caused by pneumonia. He had been with the Ford company for the past eight years.

W. A. ("Bill") Smith, president and manager of the Chattanooga Cadillac Co., and president of the Automotive Trades Association of Chattanooga, has resigned to accept the vice-presidency and general management of the Paige Co. of Memphis.

George H. Hannum, president and general manager, and C. J. Nephler, general sales manager of the Oakland Motor Car Co., departed April 1 for a three weeks' tour of the Pacific coast, visiting the principal Oakland dealers and distributors and Oakland branches on this trip.

Marlin-Rockwell Corp. to Stick to Bearing Business

New York, April 3—The following statement has been issued by the Marlin-Rockwell Corp.:

"The tax dispute of the Marlin-Rockwell Corp. with the government has been adjusted and the tax paid," according to H. C. Pryer, treasurer. "The corporation officers and directors state that the attitude of the treasury department has been fair and reasonable."

"The future policy of the corporation will be to confine itself to the ball bearing business which it operates under the Standard Steel & Bearing, Inc., of which it owns all the stock, and the liquidation of those assets which are unnecessary to this industry.

"The management states that the bearing manufacturing facilities of this corporation are the largest of any of the companies engaged in this business except the General Motors, and the newest and most modern.

"The corporation's present business reflects the general revival in activity in the automotive industry which it serves. Guy W. Vaughan, president and general manager of the Standard Steel & Bearing, Inc., has been elected vice-president of the Marlin-Rockwell Corp."

The government's original claim is understood to have been in the neighborhood of \$8,000,000.

TRACTOR COURSE AT STATE SCHOOL

Norwich, Conn., April 1—Rapidly increased use of the tractor on New England farms and in the rural districts is indicated in announcement that a brief course on management and use of the tractor has been scheduled for this spring at the Connecticut State College at Storrs. This institution is the recognized agricultural institution of the state. The course, to comprise two lectures daily, followed by laboratory work and augmented by practical talks by ex-

perts on oiling systems, ignition systems and the like, will be inaugurated April 11, and continue through the 14th. One evening will be devoted to a motion picture lecture on various phases of the tractor industry.

SERVICE CORP. OPENS STATIONS

St. Paul, Minn., April 1—The Day and Night Auto Service Corp., \$100,000 capital, Guardian Life Building, has begun operation with eight maintenance stations in the city, and organization in North Dakota, Wisconsin, Iowa and Illinois is planned. The contract with members provides they may be pulled in when out of commission, get oil and gasoline when in need, also competent repair service. A credit of \$100 may be arranged through the company for members, with certified maintenance stations. The organizers are J. E. Campbell, Earl Morse and Charles Kalscheuer of St. Paul. One station to each town of less than 6,000 population is the plan of the company.

ST. CLOUD TRUCK CO. MOVES

Duluth, April 1—Temporary quarters have been obtained for the St. Cloud Truck Co., which is to move here in a few weeks from St. Cloud, Minn., in the plant of the Duluth Foundry and Faucet Co. Several Duluth men are stockholders. Assembling of trucks will begin in three weeks, and a new name will be chosen. Sizes are 1½, 2½ and 3½ tons. J. R. Brown, vice president and general manager at St. Cloud, is expected to continue, but other new officers will be chosen soon.

EXPORT BUSINESS BETTER

New York, April 1—H. Alpern, export manager of the King Motor Car Co., reports that foreign sales for February were the largest for any month in the last five years. Agencies have been established in five additional countries. Twenty cars recently were shipped to the dealer in Switzerland.

"Bargain" Parts Endanger Dealers' Repair Business

Low Prices of So-Called Pirate Brands Attracting Car Owners in Los Angeles

LOS ANGELES, April 3—The situation in the automotive parts market in respect to prices is serious here, according to the most prominent dealers. Heavy losses in the parts business are being incurred, because of "bargain" parts and the ability of automobile owners to buy parts from others at lower prices than the representatives of the cars and trucks can sell them at profitably. Many of the dealers are protesting to their factories against this condition in the endeavor to bring about a reduction in the prices of parts to them.

Car and truck owners have adopted a policy of shopping for parts. No longer is it the custom to send a car or truck to the dealer's place if parts can be obtained elsewhere cheaper. There are so many interchangeable parts among the assembled cars and trucks that the pirate parts makers and the parts depots are enjoying a harvest. Dealers are powerless to prevent this situation, they say, because they are compelled to buy their parts from the car makers and in many instances the prices to them are higher than the parts can be bought for from others.

It has been proposed to request the factories to stamp their name on every part of any size and to designate the smaller ones in some way to indicate they are genuine. Others assert the only remedy can be a reduction in the prices charged dealers by factories. This would not need to apply to such major parts as are exclusively produced by the car builder and which can be obtained from no other source, but would have to be put in effect on all such parts as can be bought on the open market. Dealers acknowledge that the condition is one that they have been forced to avail themselves of. They say they can go to a parts depot and buy parts for the car they sell at a lower price than their factory charges them. This practice is their only method for making a profit. The garage trade that formerly was a big item in a dealer's business has been greatly endangered because the biggest discount he can give does not make the price low enough.

TRUCK INQUIRIES IN TEXAS

Wichita Falls, Tex., April 3—Inquiries for trucks are greater than at any time since 1919 and export business is picking up, according to J. G. Culbertson, president of the Wichita Truck Co. Culbertson said his plant is now turning out more than 60 trucks a month and that he expects to soon increase the output to the capacity of the plant, which is about 400 a month.

The READERS' CLEARING HOUSE

Questions & Answers on Dealers' Problems

PATENT ON STEERING GEAR

Q—I have just invented a new kind of steering gear, and I desire to know if the Patent Office will grant me a patent on a model, of which the parts are not accessible, in fact it cannot be taken apart for examination.—J. A. House, Dyer, Tenn.

Yes, you may be granted a patent, though the model cannot be taken apart for examination. There is no law requiring inventions to be thus and so, in any way limit one's inventive genius. However, the patent office may call for and require, in its discretion, a model for its own better understanding of the patent application and the required drawings of the claimed invention. Drawings of particular kinds and on specified and sized paper is required whenever the nature of the case permits of it. The drawing must show every feature of the invention covered on an old machine of the inventor. Whenever the invention consists on an improvement on an old machine the drawing must exhibit, in one or more views, the invention itself, disconnected from the old structure, and also in another view, so much only of the old structure as will suffice to show the connection of the invention therewith.

Models are required only when on examination of the patent application in its regular order the primary examiner shall find it to be necessary or useful. The model submitted on requirement must clearly exhibit every feature of the machine which forms the subjects of a claim of invention, but should not include other matter than that covered by the actual invention or improvement, unless it be necessary to the exhibition of the invention in a working model.

And a working model may be required if necessary to enable the office fully and readily to understand the precise operation of the machine.

These are rules of the patent office, and it will be seen that models may not be required at all, and then only when the invention is complex or involved and a model required for an understanding of the application.

CHAUFFEURS' LICENSE FOR MECHANIC

Q—We noticed in the Feb. 16 issue of *MOTOR AGE* a question asked your legal department as to whether a mechanic or helper in a garage is required to have a chauffeur's license in order to test out cars in the garage. You stated that in your opinion he did not.

Will he be compelled to have a chauffeur's license if he takes the car out on the public highway to test it out and not just in the garage?

Has a garage any legal means of obtaining possession of a car that has a rental battery in it that belongs to the

The Reader's Clearing House

THIS department is conducted to assist dealers and maintenance station executives in the solution of their problems.

In addressing this department, readers are requested to give the firm name and address. Also state whether a permanent file of *MOTOR AGE* is kept, for many times inquiries of an identical nature have been made and these are answered by reference to previous issues.

Inquiries not of general interest will be answered by personal letter only. Emergency questions will be replied to by letter or telegram.

Address of business firms will not be published in this department but will be supplied by letter.

Technical questions answered by B. M. Ikert and P. L. Dumas; Legal, by Wellington Custin; Paint, by G. King Franklin; Architectural, by Tom Wilder; General Business questions, by *MOTOR AGE* organization in conference.

garage?—Broadway Garage Co., Normal, Ill.

1—We are of the opinion that a mechanic or helper about a garage is not required to have a chauffeur's license in testing out a repaired car on the public highway.

2—A garage may replevin and thus obtain possession of its property where it is entitled to the possession. In case of rental battery if the rental period has expired, one may replevin the battery but not the car itself.

BODY FINISH TURNING WHITE

Q—We are troubled with wax on Hudson turning white and would like to remove it if possible. Is there any solution that would remove it? If so, advise where I can purchase same.—Main Garage, Schererville, Ind.

The above query and an answer to it were printed in the Feb. 23 issue, page 36. The following answer is printed as a more extensive analysis of the trouble.

Wax can be removed with some solvent like gasoline, benzine or alcohol, but the chances are that the trouble lies deeper and the whitening is in the film of finishing varnish. The varnishes used on automobile bodies are not waterproof and consequently cannot withstand constant contact with water. Whitening is a result of it. The difficulty is generally encountered on the flat horizontal surfaces, like the top of the cowl, hood and fenders, where the water cannot drain off. The conclusion drawn from this fact is—

do not allow water to stand on such surfaces, sponge or chamois it off. The condition is aggravated on the hood by the heat of the engine.

If this whitening and spotted condition of the finishing varnish has not penetrated too deeply it can be rubbed out with pumice powder and water on a pad and the surfaces revarnished. If the discoloration is bad the surfaces should be color varnished,—assuming of course that the paint coats are otherwise in good condition.

LOCATION OF PISTONS IN BUICK D-45

Q—We have taken the engine of a Buick D-45 apart. The pistons have been replaced in the cylinder block without taking into consideration the offset position of the piston pin in the piston. We have noticed there is an arrow inside the piston, right under the piston pin boss. This arrow points towards the thinner side of the piston. What is the proper position of this piston in the cylinder block? Should the piston be placed with arrow pointing in direction of rotation of crankshaft or vice-versa?—Hector Gauthier, Cardale, Manitoba, Can.

The pistons should be so located in the cylinders that all arrows are toward the front side of the piston and they should be pointing toward the camshaft. That is the side of the piston on which the arrow is cast should face toward the front of the engine on all pistons, this will bring the arrow point pointing toward the camshaft.

BRAKE LINING SPECIFICATIONS

Q—Supply a list or chart in regards to size, length, width and thickness of brake linings used on different cars.—Armour Bell, Knox, Pa.

We know of no book that has been published showing the data you speak of. However, *MOTOR AGE* has printed on different occasions the specifications of brake linings for the different cars. The specifications regarding the 1912 and 1913 cars were published in the April 17, 1919 issue of *MOTOR AGE*, the Specifications for the 1914 and 1915 models were published in the April 24, 1919 issue.

Specifications for the 1915 and 1916 models were published in the May 1, 1919 issue. Specifications for the 1916 and 1917 models were published in the May 15, 1919 issue. Specifications for 1917 and 1918 models were published in the May 22, 1919 issue, also the May 29 issue. Specifications for the 1919 cars were published October 9, 1919 and the brake lining equipment for 1920 cars were published in *MOTOR AGE* of July 22, 1920.

DRY CELLS USED IN CONJUNCTION WITH MAGNETO

Q—Is there any firm that makes hot-spot manifolds for 1916 Reo Six? If so give name.

2—Why is it necessary to have dry cells connected to generator of the 1916 Maxwell in order to start the motor when this car has a high tension magneto?—Henry Hjorth.

1—This information will be given by letter.

2—The dry cells on the 1916 Maxwell are not used for the generator but for the magneto to give it a strong spark at low speeds. It is a well known fact that a high tension magneto gives a very hot spark but if magneto is turned

very slowly the spark is correspondingly weak. It sometimes happens that at the low speed at which starter turns the engine the spark from the magneto would not be very strong and in some cases would not jump the spark plug gap at all.

It is for this reason that dry cells are used on this model, the magneto being of special design known as a Duplex, having a two part commutator built into the interrupter cover so that the dry cell current will improve the action of the magneto. Should the connections from the dry cells through the inductant coil to the magneto be reversed at any

place the spark from the magneto will be made weaker instead of stronger.

The same result will be obtained if the magnets are put on wrong, but if the magneto is all right as a straight high tension magneto it is only necessary to try the connections first one way at the dry cells then the other way and leave the connections whichever way the spark is the hottest. The dry cells have no effect on the generator or do they effect the running of the magneto when switch is in the "mag." position.

QUESTIONS REGARDING CONSTRUCTION OF A DODGE RACEABOUT

Q—We are building a Dodge racer with a 16-valve cylinder head, Miller carburetor and Dow Metal pistons. Would you recommend cutting down the flywheel?

2—Is it necessary to set up the camshaft one tooth?

3—How many rings are ordinarily used on each piston for dirt track racing?

4—Where could I secure a front axle with a 4 in. drop for this car?

5—What is the record on a half-mile dirt track?

6—What size tire would you use on this car for racing purposes, 32x3½ or 33x4?—L. J. Beimer, Marlin, Texas.

1—A noticeable increase in acceleration probably would be secured by reducing the weight of the flywheel approximately 10 to 12 pounds.

2—This is not necessary although it is worth the experiment. However, with the 16-valve head you have a greater valve opening and it may be possible that the original valve timing may give you the best results.

3—Two rings are generally used for racing on dirt track.

4—Would suggest that you communicate with some of the large wrecking companies. By addressing a letter to any of these firms and making known your wants they no doubt will be able to supply you with an axle of this type.

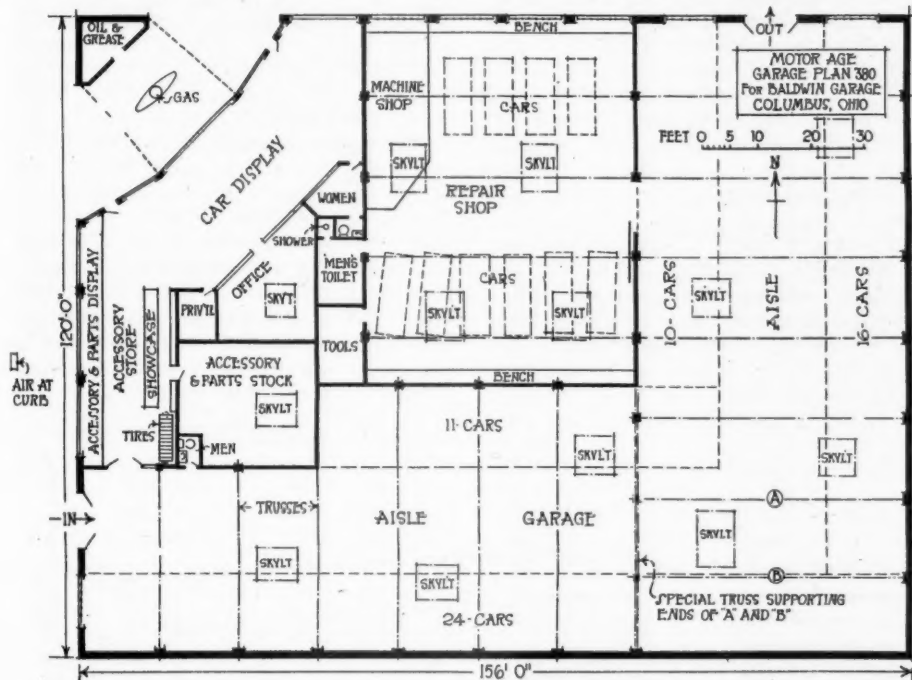
5—We have no figure on half mile dirt track records although the Fronty Ford built by Chevrolet Bros., is reputed to have equalled the unofficial record for one mile on the half mile dirt track. There are no official records recognized by the American Automobile Association, that is they do not recognize figures on the half mile track and records under five miles on a one mile track unless they are electrically timed.

6—For short distance races we would recommend the 32x3½.

CARBURETER FLOAT LEVEL ON STEVENS-DURYEA

Q—Inform us of the proper float level on the model AA carbureter, Stevens-Duryea car.—W. Francis Jones, Brookland, Washington, D. C.

If the needle valve is properly seated there should be no flooding of the carbureter. The gasoline level, however, should not be above the top of the spray nozzle. If it is too high the float can be lowered by changing the position of the cotter pin in the bottom of the rod which passes through the float. There are several holes in this rod arranged for the purpose of raising or lowering the float level.



Layout for Garage and Filling Station on Lot 156 x 120 Ft.

PLAN NO. 380

Q—We have a lot 156 x 120 ft. facing north and west on which we wish to build a modern garage and filling station. Can you supply us with plans or suggestions?—The Baldwin Garage Co., Columbus, Kan.

You have given us so little data on the requirements of your contemplated building or the nature of your business that it is impossible for us to give you anything but a general layout.

Most concerns specialize on some certain branch or at least some certain line leads the rest in activity. Here, no instructions to the contrary being given, the garage is rather larger than it would naturally be made, simply because it worked to advantage that way.

However, this may be just what you want, but if you want a larger shop

with all repair departments it would be advisable to sacrifice some of the garage to the shop. This may be done by using the section appearing now as shop for garage and making the large rear, 50 x 120 ft. section, the shop. It could also be done by leaving the shop where it is but doubling its capacity by adding the garage sections east of it.

A filling station is always a disturbing element in the making of a good garage plan, but your ample dimensions make less of a problem here than it usually is. Aside from the fact that the car display room is partially hidden behind the filling station no particular damage is done. In this respect it might be mentioned that the showroom would be lighter and more showy if no canopy is used over the pump.

gent handling of the job. Among other things, we need such information as follows:

Rough pencil sketch showing size and shape of plot and its relation to streets and alleys.

What departments are to be operated and how large it is expected they will be.

Number of cars on the sales floor.

Number of cars it is expected to garage.

Number of men employed in repair shop.

And how much of an accessory department is anticipated.

Architectural Service

IN giving architectural advice, MOTOR AGE aims to assist its readers in their problems of planning, building and equipping, maintenance stations, garages, dealers' establishments, shops, filling stations, and, in fact, any building necessary to automotive activity.

When making request for assistance, please see that we have all the data necessary to an intelli-

Theory of Storage Battery

Q—We have received your explanation in regard to lap and wave windings and their application to two and four pole generators, and understand that if a lap winding were used in a four pole machine that it would require four brushes, while the wave winding in the four pole machine may have either four or two brushes. Is this correct?

2—In regard to the number of commutator bars, however, we notice that the Ford and Auto-Lite generators which are four pole machines were shown in the articles on these systems as having an even number of commutator bars, while the Dodge generator, which is also a four pole machine, is shown as having an odd number of bars. What is the reason for this?

3—Would like to know if the following is the general principle on which storage batteries work: A chemical action takes place between the lead plates and the acid which causes a current of electricity to flow out of the positive post to the external circuit and back to the negative post, then through the acid in the battery to the positive plates again. As the current flows the acid goes into the plates, and when the current is reversed in charging again it forces the acid out of the plates again. Advise if this is correct.

4—We sent a battery to a battery station for the winter, it being a 12-volt battery, and they say it will lose its charge in about two weeks; also that one cell is shorted and that this causes the other cells to become discharged. In the cell that they say is shorted the water also goes down faster than in the others. Will an internal short in one cell affect the others?—E. H. Plummer, Webster, Wis.

1—Your statement of the brush requirements is correct.

2—The explanation of the apparent discrepancy in regard to the number of commutator bars lies in the fact that in the electrical articles being run in MOTOR AGE on various popular cars, no attempt has been made to go into the armature winding or internal circuits. Consequently when showing a commutator, some bars were shown merely to indicate that it was a commutator, but with no particular attention to getting the exact number of bars to check up with the actual armature. This accounts for there being 16 bars shown in a diagram, while the actual commutator may have had 21.

3—Your understanding is substantially correct. The plates, while made with a grid or framework of lead, are, however, different as far as the active material is concerned, when in a charged condition. In the positive plate the material between the bars of the grid is lead oxide, while in the negative plates it is spongy lead. On discharging we say that the acid goes into the plates, a more accurate explanation however being that a chemical combination takes place between the acid and the active material in both plates which changes both plates to lead sulphate.

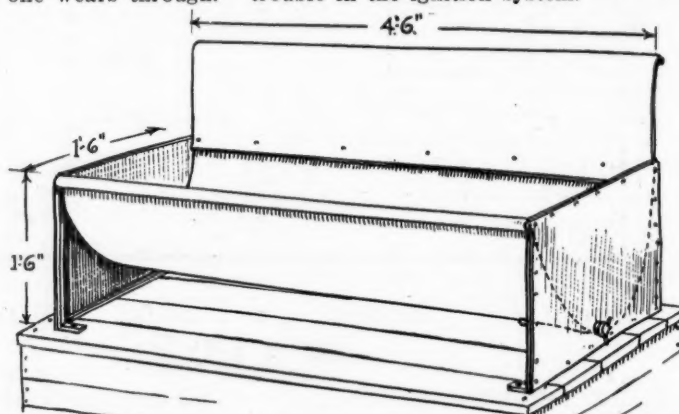
This action or sulphation of the plates is reversed when the charging current is forced through the battery in the opposite direction from which the discharge current flows, changing the plates back

into their original condition and freeing the acid again.

4—A battery losing its charge in two weeks would show a bad condition of all cells requiring new positives and separators, if indeed the battery should be worth rebuilding. The short in one cell may be detected by a voltage reading taken on it with a low reading voltmeter. This should be made with a heavy discharge current being taken from the battery. If, for example, five of the cells showed 1.5 volts each and one cell shows .2 volts or even a reading in the wrong direction, it shows it to be shorted. Should all six cells test alike however it would indicate that the water going down in one was due to a leak and not a short. In regard to a short in one cell discharging the others, would say this is not an electrical possibility, with no circuits connected, and even with circuits connected, it would only have the effect of acting as a resistance, and cutting the battery down to a 10 volt battery.

If one cell really is shorted however, it is always advisable to have all cells insulated, as the others are in such a condition that they may also give trouble at any time. The precaution of re-insulating all is similar to having both shoes re-soled when one wears through.

Fig. 1—A tank for washing parts, as pictured at the right, could be made of 20-gage material to the dimensions noted.



WASHING TANK FOR SOILED PARTS

Show sketch of a tank for washing parts to be used in a garage. Give necessary dimensions.—John H. Suter, Peoria, Ill.

The sketch of the tank for this purpose is shown in Fig. 1. Material is 20-gage, or heavier could be used in order that it may successfully meet with the hard service which it will undergo. By following the dimensions the tank can be very easily constructed. Angle iron of $\frac{1}{8}$ " x 1" is used where shown.

The drain shown at the lower right hand end of tank is constructed of any desired diameter pipe and consists of a pipe nipple four to six in. long with a washer and nut on each side of end plate of tank. A gasket preferably of composition material should be placed between end plate and washer on inside and outside. The tank can be mounted to suit, either with a wooden base as shown or by extending the angle iron legs which should be $\frac{1}{4}$ -in. thick if the wooden base is not used.

DIFFICULTY WITH CHALMERS CAR

Q—We have a Chalmers car that does not work right, as the engine misses considerably in spite of the fact that a new Stromberg carburetor has been tried out. Also intensifiers have been tried on the spark plug, but with no appreciable improvement and we would appreciate information which would enable us to tell whether the trouble is in the ignition or carburetion.—Maurer Bros. Garage, Wilton Junction, Iowa.

In checking up trouble of this nature it is best to test the ignition first. This can be done by having all the wires on the spark plugs loose so that they can be readily removed for purpose of testing. The engine should then be started and one of the spark plug wires removed from the plug at a time and held within $\frac{3}{16}$ of an inch of some metal part of the engine, the corner of the hexagon head of the spark plug being a very good place.

This makes a spark gap at which the spark can be seen to jump and as the engine runs slowly the sparks should be counted up to about 50 or 60 and if in that time the sparks jump the $\frac{3}{16}$ inch gap every time without missing, it shows that the ignition is all right. However, should the sparks jump six or eight times and then miss a shot then jump 4 or 5 more and miss another shot, it shows trouble in the ignition system.

This test should be made on all spark plug wires, although if sparks are all right on one wire they will probably be all right on all of the others. If the sparks are all right the spark plugs should then be checked up to see if they are clean, and if so, the use of an intensifier will not be needed.

The intensifier is sometimes of possible value in case the plugs are fouled up, but the best remedy for such a condition is to clean the spark plugs. If the ignition is defective and misses every few shots, it is possible that the trouble is either in the interrupter contact which may be burnt and require new points, or it may be that the ignition coil itself is weak, in which case a new one should be tried.

If the ignition is all right and the plugs are cleaned and set at from .020 to .025, it is then time enough to check up the carburetor which should be adjusted in accordance with the manufacturers' instructions, but it is useless, of course, to try to adjust the carburetor until it is definitely determined that there is not ignition trouble.

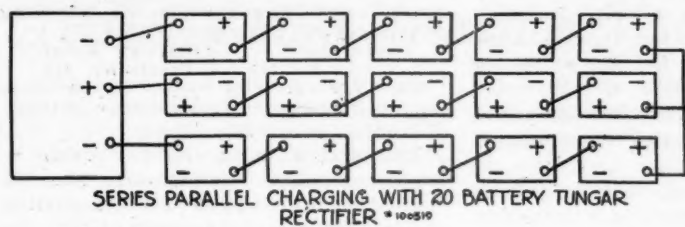


Fig. 1

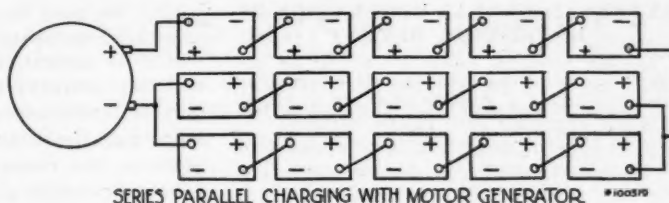


Fig. 2

Charging Batteries With Tungar Rectifier

Q—Is it possible for motor generator or Tungar rectifier to charge batteries in multiple series? If so, please give diagram.

2—Can you recommend or give any information relative to a combination still of one gallon capacity that can also be used for steaming batteries?—Baker-Wright Battery Service Station, Portsmouth, N. H.

1—The Tungar rectifier which is most commonly used is known as the 10-battery Tungar which is capable of giving out 6 amperes at 75 volts and with this current it is hardly advisable to try to use a multiple series of connections as the two sets of batteries that would be in multiple or in parallel with each other would only get 3 amperes each.

With the larger Tungar rectifier which is rated as a 20-battery rectifier, it is quite feasible to use this method of wiring, the diagram being shown in Fig. 1. On this rectifier it will be seen that there are three charging terminals, the center one marked plus and the outer ones marked negative or minus. In Fig. 1 current will go from the positive terminal of the rectifier to the center string of batteries which will receive a charging current of about 12 amperes.

When this current gets to the end of the string it will divide and 6 amperes will come back to the upper string of batteries and 6 amperes to the lower string of batteries. This method of charging makes it possible to put in the center string those batteries which are of larger size or those which are badly discharged, while those which are smaller or more nearly charged can be put in the upper or lower string.

The number of batteries can be varied from that shown in the sketch, but should always be such that in tracing through the circuits from the plus terminal back to one of the negative terminals there will not be more than the equivalent of 10 6-volt batteries. If there are no batteries which require the heavy charge rate of 12 amperes, then the center string can be eliminated and wire only used and as many as 10 batteries can be used in both the upper and lower circuits so that 20 batteries could be charged at once, each battery getting six amperes.

In Fig. 2 another diagram is shown illustrating method of connecting for series parallel charging with an ordinary motor generator. Here the upper string of batteries is shown as getting the entire output of the generator while the center and lower string of batteries each receive half of the current. This method

also could be used with an ordinary 10-battery rectifier, but the upper string of batteries would receive 6 amperes while the lower two strings would receive three amperes each.

2—This information will be given by letter.

Injecting Speed Into Old Westcott

Q—We have a Westcott car which we believe to be about a 1912 model. It has a four-cylinder Rutenber engine, No. 11696. The cylinders being cast individually. It is equipped with 36x4 tires. We would like to rebuild this into a racing car and ask your advice on the following:

2—What is the bore and stroke of this engine?

3—What is the maximum speed of this car?

4—With the proper gearing, what speed would be possible?

5—Just what should be done to accomplish this speed?

6—What is the correct date of manufacture of this car?—Rex Motor Car Co., St. Louis, Mo.

1 and 2—The following information has been supplied by the Westcott Motor Car Co. In their letter they state that no record was kept of the cars by the engine number, but that series of engine numbers was used during the season of 1912 and that the bore and stroke of the engine referred to was $4\frac{1}{2}$ by 5.

3—The maximum speed of this car depended on whether it was a roadster or a touring car. The roadster was equipped with a gear ratio of 3-1/6 to 1 whereas the touring car carried a gear ratio of 3-4/5 to 1. With the 3-4/5 to 1 gear ratio it should do approximately 45 m. p. h. under average conditions.

4—The Rutenber engine built during 1912 was a slow speed engine with a maximum speed of approximately 2000 r. p. m. Assuming that you can maintain an engine speed of 2000 r. p. m. with a gear ratio of 3-1/6 to 1 and using 36x4-in. tires, a theoretical maximum speed of 67 m. p. h. can be secured. This being a theoretical speed, it should be deducted by approximately six to ten per cent to give the actual speed.

5—It is impractical to attempt to convert an out-and-out slow speed engine into a high speed engine, especially an engine of this large bore. The proper procedure to follow would be to put the engine in as good shape as possible by

having the crankshaft reground and the cylinders reground and fitted with new pistons. The addition of light weight pistons will do much toward preventing vibration and will probably give slightly better heat utilization of the fuel.

Beyond a general overhauling of the engine we would not recommend any changes other than the installation of a high grade ignition system, such as a high tension magneto or some of the battery systems now in use. To increase the speed then it is necessary to lighten the chassis wherever possible and to increase the gear ratio to the highest possible value. The type of racing which this car is to be put to will determine the gear ratio that will be most efficient.

However, you will note that with most all of the slow speed engines a great amount of flexibility cannot be secured and if you intend to use the car for dirt track racing we would not advise the installation of a gear ratio in excess of the regular 3-1/6 to 1 which was used on the stock roadster. If the car is to be used for level country racing or on the speedway it might be possible to increase the gear ratio to 3 to 1 or possibly 2-7/8 to 1.

6—This information is given in answer 1.

NEW CARBURETOR FOR 1917 STUDEBAKER

Q—We have a 1917 four-cylinder Studebaker car on which carburetor is in bad shape. This carburetor has been repaired a number of times but still leaks considerably. Would it be best to have it rebuilt at factory or should we put on a new carburetor designed to handle present day fuel?

2—What is size of cylinder for this model?—Ross E. Decker, Bellevue, O.

A—We would recommend the new carburetor although the old one could be factory rebuilt or the makers of the old carburetor might allow some rebate on the purchase of a new one.

2—The size of cylinders on this model is $3\frac{3}{8}$ x5.

CADILLAC 61 CHAIN ADJUSTMENT

Q—Publish illustration of Cadillac fan shaft and camshaft chains on new models with explanation of how adjustments are made.—Standard Oil Co., Louisiana, M. L. Marks, Baton Rouge, La.

The reprint of this cut and instructions for adjusting will be sent you by mail.

EXTERNAL MANUAL REGULATION OF GENERATOR OUTPUT

Q—We wish to know if it will be alright to use a rheostat in series with the field circuit of a generator so as to regulate the charging rate to the battery?

2—Would it be alright to cut the field circuits and insert the rheostat so that it would be in series?

3—We are showing herewith diagram of a Remy generator which we are taking for example. The rheostat is shown connected between the thermostat and the field leads which normally connect to the thermostat. Is there any better place to connect the rheostat?

4—Advise if this will work on all generators of the design. Also what ohmage resistance and ampere carrying capacity the rheostat should be for a 6-volt generator and also for a 12-volt generator.

5—Would an ordinary rheostat as used on wireless apparatus be satisfactory?

6—Would there be any damage done to the generator should the rheostat burn out, or would it cause the armature to burn out if the generator field circuit should become broken?

7—Would this arrangement work on a generator that does not have the third brush regulation?—P. A. Baker, Blairsville, Pa.

1—This method of regulating the current output is perfectly practicable but it is usually not very convenient to insert a rheostat in the circuit in the manner you suggest.

2—The rheostat may be connected in series with the field circuit at any place where such a connection is possible, one place having no advantage over the other place.

3—We are reproducing with but slight change the sketch you sent. We believe this is the best place to insert the rheostat, as it is the most accessible, although there is no preference from an electrical standpoint.

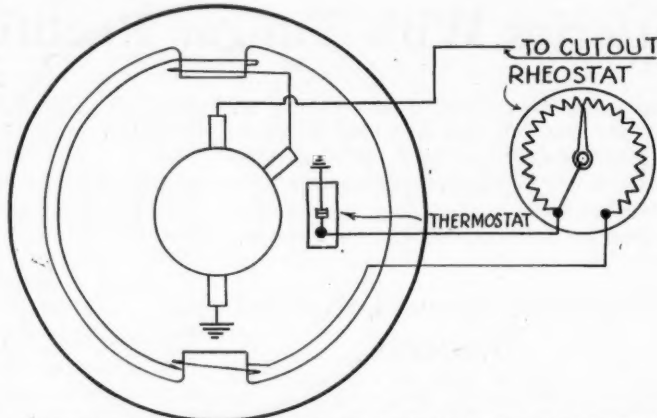
4—This method will work on any automobile type generator but to determine the resistance required is a matter of experiment. To make a first guess we would suggest that you connect the field circuits to a six-volt battery, assuming of course, you have a six-volt generator and see how many amperes the field draws. The rheostat should then be capable of handling this much current or in other words this would be its ampere rating.

Assume now, that on a six-volt battery a field circuit should draw two amperes. To find the resistance of the field we divide six volts by two ampere and find that it is three ohms. It is our opinion that the rheostat itself should have a resistance of from four to 12 times the field resistance, which in this case would be from 12 to 36 ohms. The same general method of making a first guess

would be used for a 12-volt generator.

5—A rheostat used for wireless work would be alright if it had the amperage capacity above indicated and have the correct resistance. These two characteristics usually being indicated on a name plate on the rheostat.

6—No possible damage could result to armature or other parts of generator due to rheostat being opened as a generator with an open field circuit merely stops



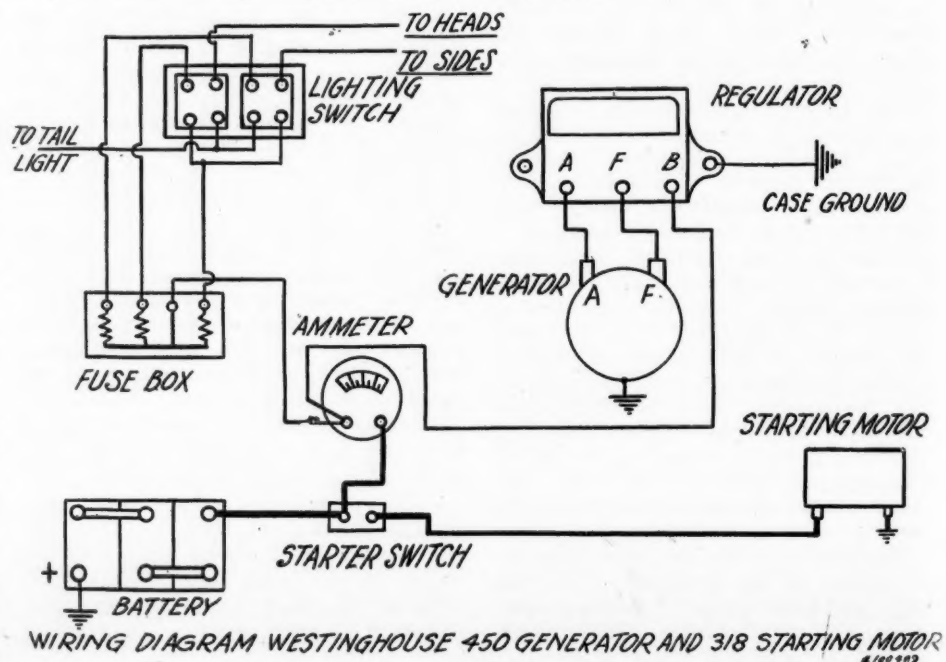
GENERATOR WITH RHEOSTAT IN SERIES WITH SHUNT FIELD TO REDUCE CURRENT OUTPUT 100487

generating but does itself no harm. What you probably have in mind is the damage done when the wire between battery and generator becomes broken, as this does not keep the generator from generating, but it has no place to send its energy.

7—This arrangement will work with any type generator, the only point being that if a third brush regulation is used the amount of resistance required will be less than if there is no third brush regulation. We recommend this method of control over that which merely throws away excess generator output but generator construction usually makes it difficult to install.

DIAGRAM WESTINGHOUSE SYSTEM

Q—Give us wiring diagram of 1915



Stewart touring car using the following Westinghouse equipment:

Generator Starting Motor

Frame No. 450 Frame No. 318

The generator is chain driven from the magneto and pump shaft.—Anthony F. Sauter, Jr., Buffalo, N. Y.

The sketch below shows which is correct for the Westinghouse No. 450 frame generator and the No. 318 starting motor, and it will be observed that the generator requires a vibrating type regulator which also acts as a cut-out. While you did not state the exact type of fuse box and lighting switch used with this equipment, we assume that it is the standard Westinghouse material and have shown the diagram accordingly. In this system it is very important to make sure that the case of the regulator is grounded or connected to the frame of the engine, also to make sure that the A and F wires are not reversed.

DATA ON FOUR WHEEL DRIVE TRUCKS

Q—Advise me what method of driving is used for the front wheels in four wheel drive trucks such as the FWD or Nash Quad. Is the drive through universal joints, and if so, are these specially designed universals?

2—Is there a four wheel drive electric truck on the market? Was there such a truck built, with the motors actually part of the wheels?

3—Where could I secure some practical information regarding electrical vehicles?—H. C. Dearborn, Peoria, Ill.

1—The drive on both the FWD and the Nash Quad was taken through especially designed universal joints.

2—A four wheel drive electric truck was manufactured by the Couple Gear Freight Wheel Company, Grand Rapids, Michigan. The motor for each vehicle being enclosed within the wheel. The Couple Gear Freight Wheel Co., who manufactured this truck is no longer in business.

3—Would suggest that you communicate with the U. P. C. Book Co., 239 W. 39th St., New York. Make known your wants to them and no doubt they shall be able to furnish you with the necessary book.

Testing a Ford Armature With a Weston 280-Volt Ammeter

Q—Advise how to test a Ford armature with a Weston 280-volt ammeter.

1—The best test you can make for shorts and opens in a Ford armature using the Weston 280 meter is to use it as a milli-volt meter with certain current going through the armature. The armature should be mounted so that it can be turned readily and contacts should bear on the commutator at 90 degrees from each other, in other words at the brush position.

In doing this it would be well to have a variable resistance in series with the battery which is sending current through the armature so that the amount of this current can be varied. With a slight current now flowing through the armature the two leads from the milli-voltmeter can be touched on adjacent commutator bars and the milli-voltmeter reading observed. If the reading is very small more current should be allowed to go through the armature, while if the reading is too big the amount of current should be reduced.

With satisfactory readings on the milli-voltmeter the readings at different pairs of commutator bars should be compared and with a normal armature these should be the same all the way around. Should the reading be 20 milli-volts and 21 milli-volts and then 40 milli-volts, it would show trouble due to an open circuit, whereas if the reading was usually 20 milli-volts and suddenly dropped down to two or three milli-volts, it would show a short circuit.

To test for grounds the voltmeter and not the milli-voltmeter can be connected in series with the battery and the armature, one lead to the armature being connected to the shaft and the other to the commutator. In this case the reading on the voltmeter shows that the winding is grounded whereas no reading shows it to be all right.

Amperes draw of Ford generator field winding

2—How many amps. should the field windings of a Ford generator draw when connected to a 6-volt battery?

2—The whole field including all four coils when connected across a 6-volt battery should draw about two amperes, while only one coil is connected it should draw four times the current or about 8 amperes.

Ford wiring with and without starter

3—Advise the difference in wiring the Ford car when equipped with a starting and lighting system and when not so equipped, the lights in the later case being operated from the magneto.

3—On the Ford car when starting and lighting system is not provided current from the magneto terminal post goes to the lighting switch then through the lighting switch to one head lamp, through it to the other head lamp and finally to ground. The headlamp bulbs used are 9-volt bulbs and as two of them are in series they are lighted up properly when the magneto is developing 18 volts.

When the starting and lighting system is used the headlamp bulbs are 6 volts and are connected in parallel, that is, the current from the battery goes through the ammeter to the lighting switch and then to the headlamp, but before reaching the lamp it divides at a junction block on the left side of the dash and the two branch circuits carry a current through headlamps to ground. From the above illustration it will be obvious that the lights of one system are not suitable for the other system.

Storage battery under front seat

4—Show how to put the storage battery under the front seat of a Ford roadster.

4—It would be hardly advisable to attempt to install storage battery under the front seat of a Ford roadster, although such a location is desirable from the standpoint of accessibility. To do so would necessitate the use of a special tank shorter than the regular tank. The regular location makes the battery accessible through the rear drawer in the storage compartment behind the front seat.

Hotspot for the Ford

5—What company manufactures the best hotspot for a Ford car? What is your opinion of same?

5—This information will be given by letter. We consider the use of a hotspot very desirable.

Device for Testing Ford coils

6—How can we make up a good device for testing Ford coils? What amperage should they draw when properly adjusted?

6—For testing Ford coils a wooden box or frame work can be made just slightly larger than the Ford coil box and with brass spring clips so located as to make contact with the terminals on the coil box. These two terminals at the side of the Ford coil go to a spark gap and the other connection should be such that battery current goes through an ammeter and the other connections should be such that battery current goes through an ammeter then to the terminals at the bottom of the coil and from the upper terminal at the side of the coil through a switch and back to battery.

Adjustment of the Ford coil should be such that the current is from 1.25 to 1.5 amperes. Another thing to judge by is the sound of the vibrators as this is a direct indication of the speed of vibration and if the speed of vibration is the same on all four coils it means that the uniform firing will be obtained in the different cylinders.

Difference between malleable and cast iron

7—How can you tell malleable iron from cast iron?

7—Malleable iron can usually be detected by a sort of slippery shiny appearance somewhat as if graphite had been rubbed over the surface, whereas the surface of cast iron is rougher and

more like sandpaper and does not have the same gloss or shine to it.

Welding malleable iron with Tobin bronze

8—How can malleable iron be welded with Tobin bronze?

8—In welding malleable iron with Tobin bronze it is well to clean up the surfaces to be joined and shape them in such a way that the two pieces touch at the bottom of the weld but leave an opening into which the welding material will run easily. The edges to be joined should be brought to heat just a little below the point at which they will flow and the opening should then quickly be filled, using the rod of Tobin bronze. In this work a bronze flux should be used which can be made from calcined borax, this being borax which has been heated until practically all the water has been driven out. This borax may also be mixed with about 15 per cent of sal-ammoniac to make a satisfactory fluxing powder. This powder may be made into a paste with water if desired so that it can be applied to the point to be brazed before heating. The rest of the powder should be kept dry for use during the welding operation.

Making ammeter into panel board

9—How can a Weston 280-volt ammeter be built into a panel board with switch so that the same connections are always used and the switch only is turned to give the desired circuits?—Wm. Johnson, Mc-Ville, N. D.

9—In regard to mounting the Weston 280-volt ammeter on a panel so that the same connection can always be used and different scale readings the same by merely turning the switch would recommend that you make no attempt to do this, as the complication is worse than using the meter as it is. It is possible to make some such arrangement by connecting all three shunts in series with each other, starting with the largest and using the next size shunt and finally the smallest one.

The two leads from the milli-voltmeter should then be connected to the extreme end of this string of shunts and when desired to use the outfit as an ammeter the leads from the circuits should be connected with the shunt that is suitable for the current being measured. However, this would produce some inaccuracy as when one shunt is being used the other two would be in series with the leads to the milli-voltmeter and the readings would not be exactly correct.

Also if permanently hooked up in this way the milli-voltmeter would not be available as such. Instead of having the shunts loose in a box or metercase, however, would suggest that it might be well to mount these on a board so that they can be used on a car without danger of their rolling over and coming in contact with running board or other grounded portions of the car.

Analysis of Valve Motion on Six Cylinder Engine

Q—I have designed a 6-cylinder 4x5½ in. engine and would like to know the approximate h.p. and r.p.m.

2—How many m.p.h. will a car make with this engine, using 32x4½ in. tires and a gear ratio of 4.49, also 3.50?

3—Tell me what valves work together, on a 6-cylinder engine whose firing order is: 1-5-3-6-2-4.—C. J. Summers, Memphis, Tenn.

1—This engine if well designed should develop approximately 50 h.p. The maximum revolutions would be in the neighborhood of 2900.

2—This is a question that cannot be answered with any accuracy, because so many conditions enter into the proposition. Considered theoretically the engine without making any allowance for wind resistance should drive a light chassis at about 65 m.p.h. for the 4.49 gear ratio and above 75 to 80 for the 3.50 ratio.

All of the answers given here are not to be considered except from a theoretical standpoint and the figures are based on average design and performance.

3—The crank throws on a six cylinder stationary engine of the four cycle type are placed 120 degrees apart. The crankshaft must make two complete revolutions in order to fire the six cylinders. The following table shows the position of each valve and each piston during the 720 degrees of rotation of the crankshaft.

Firing Order	When No. 1 Piston is	No. 5 Piston is	No. 3 Piston is	No. 6 Piston is	No. 2 Piston is	No. 4 Piston is
1	Top on Firing	1/3 of a revolution from top of up compression stroke	1/3 of a revolution from top on down intake stroke	Top on exhaust	1/3 of a revolution from top on up exhaust stroke	1/3 of a revolution from top on down firing stroke
5	1/3 of a revolution from top on down firing stroke	Top on Firing	1/3 of a revolution from top on up compression stroke	1/3 of a revolution from top on down intake stroke	Top on Exhaust	1/3 of a revolution from top on up exhaust stroke
3	1/3 of a revolution from top on up exhaust stroke	1/3 of a revolution from top on down firing stroke	Top Firing	1/3 of a revolution from top on up compression stroke	1/3 of a revolution from top on down intake stroke	Top on exhaust
6	Top on exhaust	1/3 of a revolution from top on up exhaust stroke	1/3 of a revolution from top on down firing stroke	Top firing	1/3 of a revolution from top on up compression stroke	1/3 of a revolution from top on down intake stroke
2	1/3 of a revolution from top on down intake stroke	Top on exhaust	1/3 of a revolution from top on up exhaust stroke	1/3 of a revolution from top on down firing stroke	Top firing	1/3 of a revolution from top on up compression stroke
4	1/3 of a revolution from top on up compression stroke	1/3 of a revolution from top on down intake stroke	Top on exhaust	1/3 of a revolution from top on up exhaust stroke	1/3 of a revolution from top on down firing stroke	Top firing

HINTS ON NORTHEAST GENERATOR

Q—We have a Northeast motor generator model G on a Dodge car which has been thoroughly overhauled and tested for shorts and opens in armature and field windings. We have also installed a new set of brushes and have tested brush holders for grounds. After doing this and finding everything alright, we installed same on car, started engine with the starter and just as the engine started the ammeter showing 12 amperes charge and immediately dropped to 4 amperes, and now will not charge any more than 4 amperes, even with third brush advanced as far as possible. What is the trouble?

1—The 12 amperes charge at the first instance is possibly due to the third brush making contact with the commutator at one edge only, this apparently being the edge which would give highest output. The low output with everything apparently alright is discussed in the September 1, 1921 issue of MOTOR AGE, page 24, second column, to which we would refer you for thorough description. Briefly the use of a special third brush arm shorter than the standard brush arm is the method used when this part is available. Otherwise it is neces-

sary to cut an extra tooth in the sector so that the necessary shifting of the third brush can be made. We would also call your attention to the fact that when installing new brushes the two yellowish ones should go in the main brush holder while the black brush is for use in the third brush holder.

READER DESIGNING AIR COOLED ENGINE

Q—I am building an air cooled engine, 4 cylinder, 4 cycle, valve in head, cooled as Fox with fan in front, 2½ in. bore and 4 in. stroke, 1¼ in. valves, speed 4000 r. p. m. What compression ratio would you select? What is the Fox compression ratio? The Franklin and the Holmes?—Ray Hazen, Kansas City, Mo.

Information regarding the exact compression ratio of the cars mentioned is not available. We would state that the compression ratio to select would depend upon one or more factors. The work to which the engine is to be subjected and the h. p. expected. For aviation work a higher compression ratio than for automobile work is usually used. However, the common practice is to have a max-

imum of approximately 4¼ to 1 compression ratio for air cooled engine.

It might be a good plan to start out with a compression ratio of about 3½ or 4 to 1 and give the engine a thorough test which would determine whether it would be safe to increase this ratio or not. We believe you shall encounter considerable difficulty in securing 4000 r. p. m. and we would be pleased to hear from you in the future regarding what progress you have made along these lines.

INSTALLING HOT-SPOT ON OVERLAND 83

Q—We wish to install a hot-spot on an Overland model 83. Can you give me the names of concerns who make a hot-spot to fit this model?

2—What is the correct valve clearance for this car?—Charles Ickenroth, St. Louis, Mo.

1—This will be answered by letter.

2—The correct clearance for the tappets on this model engine is .012. These tappets should be set to this clearance when the engine is at normal running temperature.

CAUSE OF NOISE IN REAR AXLE OF FORD SEDAN

1—What would cause a noise or growl in the rear axle of the 1921 Ford sedan?

1—The first thing to check up in a Ford rear axle is to make sure plenty of grease is used and in very cold weather a type of grease or heavy transmission oil must be used which will get to the gears and not stick as a solid mass on the axle housing. If there is plenty of soft grease in the rear axle and the axle is still noisy, the only thing to do is to overhaul the axle and check up for worn parts.

In doing this special attention should be given to the babbitt thrust washers at the left side of the axle which, if worn, will allow the gears to get too much out of mesh which will make them noisy. The condition of the Hyatt roller bearings at the sides of the differential should also be examined and if they are badly worn they should be replaced.

Timing Dixie Magneto on 1914 Regal

2—Give us information which will enable us to time a Dixie magneto on 1919 Regal four-cylinder car.—Geo. Stancombe, Pontiac, Mich.

2—To time the Dixie magneto the engine should first be set on dead center. To do this, have all of the spark plugs out of the cylinder and then hold your thumb over the spark plug opening in the number 1 cylinder and turn the engine over by hand until a compression is felt to blow past your thumb.

This shows that the piston is coming up on the compression stroke and a stiff wire should then be used to feel the piston and the engine turned until the piston is exactly at the top of the stroke or has barely started down, perhaps 1/64 of an inch.

The engine is now properly set and should be left in this position until the magneto is set. To set the magneto it the engine will drive it when coupled up and the interrupter housing which controls the spark retarded and advance should be turned in the same direction that the magneto shaft will turn when the engine drives it. That is, the control should be in the fully retarded position. This will put it in the retard position. The shaft should now be turned slowly by hand and the interrupter points watched, the shaft being turned until the points are just about to open, the high spot on the cam just making contact with the fiber on the interrupter arm.

The magneto is now ready to fire and the engine is now ready to receive the spark so that the magneto should now be coupled to the engine and the timing will be correct. The distributor cap where the high tension wires go should now be removed to see which one of the brushes is touching the rotating high tension segment. This brush which is in contact with this segment will be the terminal to connect to the number one cylinder.

The engine should now be turned half a turn and the distributor location again

observed and the brush where the distributor segment is making contact will be the one to connect to the next cylinder to fire. The other high tension terminals on the magneto will be connected in similar manner.

If the firing order is not known it can easily be found by watching the valves, paying no attention to the intake valve but watching the exhaust valves only, turning the engine over and observing in what order the exhaust valves come up. It is also possible to check the firing order by finding out whether the number two or number three cylinder has its compression after the number one.

If number two cylinder has compression after number one cylinder then the firing order is 1, 2, 4, 3; but if number three cylinder has compression after number one, then the ring order is 1, 3, 4, 2. We do not believe a wiring diagram will be necessary for the Dixie magneto and aside from the high tension wires the only connection is from a grounding switch to the interrupter terminal on the magneto and from the other terminal of the grounding switch to the engine or frame of the car.

CHEVROLET, FORD AND S. A. E. INQUIRY

Q—Publish wiring diagram of Chevrolet 490 and advise how to wire up for lighting and starting without ignition.

2—Advise how S. A. E. ratings are determined.

3—How much do you think a set of Dunn counterbalances will increase the horsepower of a 490 Chevrolet?

4—Will a Ford with reground cylinders have more power than a Ford with new engine?

5—What kind of oil should be used in an Auto-Lite starter?

6—How are the valves situated in a T head motor?

7—Where can I get a good welding apparatus for all kinds of garage work?—Willard Ward, Round Valley, Nebr.

A—Wiring diagram of 490 Chevrolet is shown below. This car using battery ignition, it is hardly feasible to wire up for starting and lighting only, as the ig-

nition is required before engine can be run.

2—The S. A. E. hp. rating for engines is determined by multiplying the diameter of the bore by itself and by the number of cylinders and dividing by 2½.

3—This information will be supplied by letter, as far as the Chevrolet 490 is concerned.

4—In regard to the reground Ford engine, it will theoretically have a little more power on account of the slightly increased diameter of the cylinders. The amount will probably be so slight that it would be difficult to tell it in the action of the car.

5—A few drops of light oil every 500 miles in the oiler of the Auto-Lite starting motor is the recommendation given in the Chevrolet instruction book.

6—In a T-head motor the exhaust valves are on one side of the engine and the intake valves on the other side of the engine, two camshafts being required.

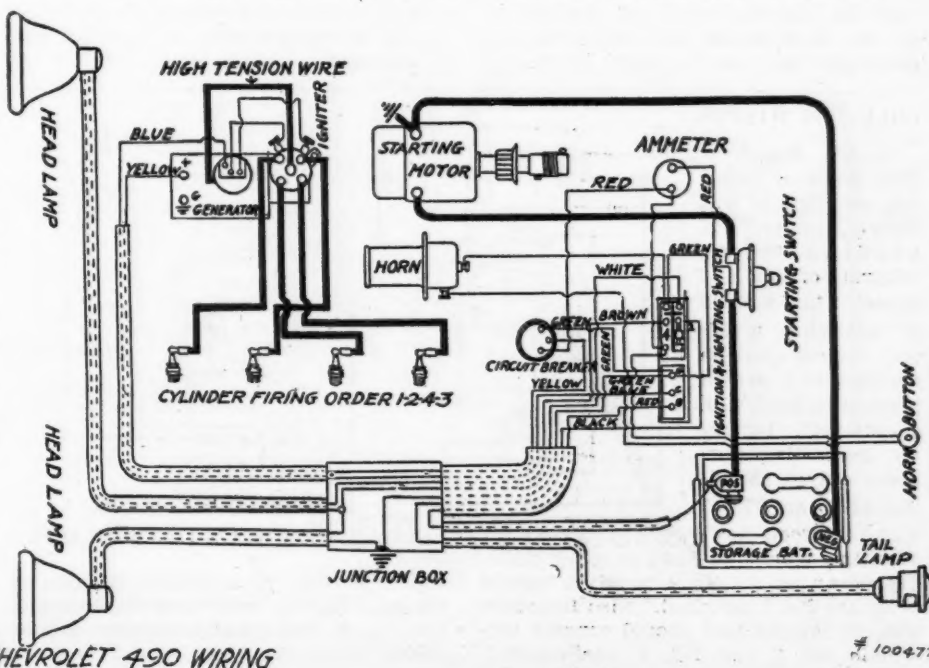
7—This information will be supplied by letter.

IMPOSSIBLE TO CHARGE BATTERY FROM A C CURRENT

Q—Is it practical to use a series of lamps in order to transform A C current back to D C current to charge batteries, and if so will you furnish me with a diagram for wiring same.—Brick Garage, Lorraine, Texas.

It will be useless to supply you with a diagram as it is impossible to charge a battery with A C current regardless of whether you have a series of lamps or not. The function of the lamps is merely to dissipate the current and they are used only where battery charging is done in cases where the source of supply of current is D C with a high voltage such as 110.

If you wish to supply batteries from this A C current it will be necessary to secure a rectifier or a direct connected motor-generator set. As before stated the lamps have nothing to do whatsoever with changing the type of current.



Testing Field Coils in Dodge Generator

Q—Where can we buy wire for rewinding a Dodge generator armature?

2—How can we test the field coils in a Dodge generator?—Lester J. Peterson, Isabel, S. D.

1—This information will be given by letter.

2—To test the field circuits of the Dodge generator the brushes should be lifted from the commutator if the machine is still assembled and paper should be put under them so that they do not touch the commutator. The field fuse should be removed and the ground strap should be removed which connects the series windings to ground.

If you have a December 1 issue of MOTOR AGE, it will help some to refer to Fig. 4 shown on page 23. To test the field windings for ground and shorts between the shunt windings and series windings, would suggest that you rig up a 110 test light by connecting from one side of the 110 directly to one of your test points and from the other side of the 110 volt circuit to a lamp and from the lamp to the other test point.

When the test points are touched together the lamp will light up. To test the field windings for ground one of the test points can be put in contact with the frame of the machine and the other test points touched first at the main terminal, then at the two main brushes, then at the third brush and at the ungrounded fuse clip. On all of these tests the lamp should not light up and if it does it shows a ground in the field being tested.

If a ground is discovered it will be necessary to dismantle the machine and remove the defective coil and put fish paper or tape between the coil and the pole piece or frame where the ground takes place. The 110 volt test should also be used to see if the shunt winding is shorted to the series winding.

To do this one test point can be put on the third brush and the other test point put first on one main brush and

then on the other main brush. To test the shunt winding to see if it is about right, you should connect up a 12-volt battery and an ammeter and send current through this winding making contact at the third brush and at the other end of the shunt winding which will be found on the insulated fuse clip.

With a 12-volt battery the current should be about 17 amperes. If only a 6-volt battery is available, the current should be about half as much or 8.5 amperes. If there are no grounds or shorts in the field coils and they are not shorted to each other and the shunt field draws the right current, there is not much possibility of anything being wrong in the field.

About the only other possible test that might be made would be to check up the polarity by using a compass with current running through the shunt field and the compass moved at different points around the outside of the frame. At one field pole the needle should point toward the frame and at the next it should point away. At the third field pole it should point toward the frame and at the fourth one away from the frame, showing that the magnetic action is alternating at the different poles.

CORBIN BROWN SPEEDOMETER ON FORD

Q—We have a Corbin Brown speedometer taken from a motorcycle on a Ford speedster, and it registers too slow in miles per hour and also on the season mileage. It is of the governor type and registers up to 80 m. p. h. I have a Stewart Standard right hand swivel joint and chain. Is that the correct direction, and what size gears would you advise to use?—Harry S. Boes, Terre Haute, Ind.

To secure the proper ratio for this speedometer it will be necessary to secure a Corbin Brown swivel joint of 1 to 1 reduction. The Stewart joint which is of $2\frac{1}{2}$ to 1 will not work successfully on this speedometer. The address of the Corbin Screw Co. is 335 N. Wells St., Chicago, Ill. They will be able to provide you with equipment necessary to operate this speedometer satisfactorily.

Full Floating Axle Defined

Q—Define a full-floating axle. The writer contends that full-floating axles are like those found in Winton, Maibohm and others where axle is removed by taking off hub cap. Others argue that such cars like Dodge, Buick, Chandler, etc., have full-floating axles.

The writer says that these axle-shafts cannot be full-floating since axles are keyed to hub and hub in turn is bolted to wheel making them function the same as any other three-quarter floating axle such as found in the model R Hupmobile and many others. Who is right?

2—The writer also maintains that a real cantilever spring is like those used on the Chevrolet car. All other so-called full-cantilever springs are generally referred to as cantilever type.—Pioneer City Auto Co., E. J. Rech, Service Mgr., Marietta, Ohio.

In the full-floating type of rear axle the weight is taken from the axle and supported on the housing through which the axle passes. The hubs of the wheels are outside of the housing and the bearings are between the inside of the hubs and the outside of the housing. There are several applications of the full-floating principle axles. The Winton, the Dodge, and the Chandler are examples of full-floating axles.

The only difference between a Winton or Cadillac and the Dodge full-floating axle is the method of securing the axle driving shaft to the wheel. In one case this is done through the splines in the hub with corresponding splines on the flange of the axle which interlock. In the other case the splined principle is involved but the axle driveshaft is equipped with a flange which fits over studs on the hub to which the driving shaft axle is bolted.

This construction is used on the Dodge. The axles are not keyed to the hub, but are keyed to a flange which is bolted to studs on the hub, however, the wheel is mounted on two roller bearings, these roller bearings are on the outside of the axle housing and take the entire weight of the car, thus relieving the axle shaft of everything except the driving and torque strain. The full-floating axle can be distinguished from the $\frac{3}{4}$ floating axle in most cases by the fact that the $\frac{3}{4}$ floating axle has one bearing to carry the weight of the wheel whereas in the full-floating two bearings are used an inner and an outer bearing. As before stated the method of driving the wheels does not in any way change the status of the full-floating axle. The Winton and Cadillac are examples of the full-floating type or modifications of the same full-floating axle as the Chandler and Dodge. Both are truly full-floating axles.

2—It is true that the Chevrolet spring axle which is a true cantilever and is practically the only spring that is supported at only one point, at the end, however, the nomenclature of the industry has been so modified that all springs of the type whether they be anchored at one or two points are classed as cantilever springs. These springs are also known as $\frac{1}{4}$ elliptics.

COLE 1913 WIRING

In the March 2, 1922, issue of MOTOR AGE on Page 39 was shown under the heading, "Wiring Diagram of Cole and Kissel," the method of changing a 24-volt system used on the Cole 1913 so that it could be used with a six-volt battery for generating purposes only. The illustration in Fig. 1 was incorrect, however, the ground being shown on the No. 4 terminal instead of on the No. 3 terminal. Also the short wire or jumper that should connect terminals No. 2 and No. 4 was omitted.

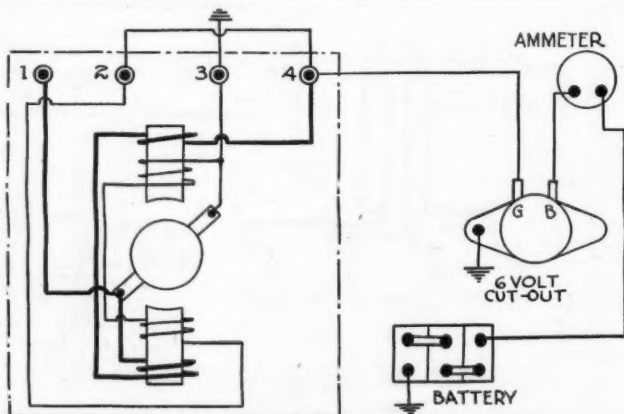


Fig. 1 in this issue shows the correct wiring. Inquiry was from N. Serensen, care L. S. Donaldson's Garage, Minneapolis, Minn.

DASHPOT ACTION ON 1922 MARVEL CARBURETER

Q—On the Marvel carbureter with which the 1922 series Buick Six is equipped there is a small brass cup beneath the air intake chamber. This cup contains a close fitting disk connected by a lever to the air valve. What is the purpose and action of these, also how is the throttle operated, carbureter, heat control adjusted for seasonal variation in temperature?

1—The function of this disk referred to is to retard the opening of the air valve so as to secure a better acceleration. This action can be best explained by a brief description of the carbureter. The mixing chamber contains the air valve and the high speed nozzle.

The air valve is pressed against its seat by an adjustable spring which is housed inside of the air screw constituting the air adjustment. As the speed of the engine increases the velocity of the entering air increases until the air valve is lifted from its seat and at the same time an additional amount of gasoline is taken from the high speed nozzle.

This air valve is hinged on the insert which is housed by the mixing chamber and the insert also carries the spray nozzle already referred to. On the under side of the insert is located a dash-pot which houses a plunger valve or diaphragm which in turn retards the too quick opening of the air valve in acceleration of the engine thus assisting in acceleration or quick pickup. The dash-pot fills with gasoline automatically, the supply of gasoline for same coming from the back wash or drift occurring when the carbureter is primed for starting, and finding its place in the dash-pot by gravity from the mixing chamber.

The dash-pot is just as effective when operating without gasoline as with it, nor is its action effected by the quantity of gasoline in it. The purpose of allowing gasoline to get in it at all is merely for lubrication, hence the dash-pot is entirely automatic and requires no attention and should be left entirely alone.

The setting provides for the most heat obtainable and should be used this way during the entire year except in extremely hot climates or where high test gasoline is being used in engine and even then should not be changed unless engine is losing power due to excessive heat. This pertains to the setting of the heat control.

If loss of power due to too much heat is experienced the connecting rod from the valve in the exhaust pipe (which is the largest valve) and the upper valve should be removed from the lower hole in the throttle arm of the carbureter and placed in the upper one.

This gives the effect of allowing less heat to reach the carbureter by not opening the heat valve in the exhaust pipe quite as much as it was previously opened. However, under average conditions as experienced in the middle West and using the present day gasoline there

should be no occasion for changing the present adjustment of the heat control.

Maximum Speed of Buick 22-665

2—What is the maximum speed of the stock model Buick 22-655, and what mixture will give this speed slightly rich or slightly lean? What are the tests for this adjustment?

2—This cannot be stated accurately, however, it lies in the neighborhood of 65 m.p.h. and the mixture that will give the best speed can be determined only by experiment. Whether it is rich or slightly lean depends upon the characteristics of the carbureter. Theoretically, though, there is slightly more gasoline used at high speed.

Publishers of Blue Book

3—Who publishes the Blue Book?

3—The Hill Binding Co., 910 S. Michigan Ave., Chicago.

Spark Current from Ford Magneto

4—Since the current furnished by the Ford magneto is alternating why will not the Ford coil which is a transformer deliver a spark to the plugs without the primary current being broken by the vibrator?

4—Under the conditions outlined a Ford coil would deliver a spark but it could not be accurately timed to the engine, consequently without accurate timing it would be impossible to secure any benefit from the spark. It is for this reason that the commutator or timer is used. Much experimental work has been done in an attempt to utilize the alternating current in conjunction with a multi-lobed cam. A limited number of such systems are in use.

Books for the Semi-Engineer

5—Names of some books with their publishers which would be helpful to an automotive mechanic who desires to become a service engineer in the sense that the term has recently been used in Motor Age.—Rock Moorhead, Findlay, C.

5—Books that will entirely fulfill your wants in this respect are furnished by the U.P.C. Book Publishing Co., New York. The foremost among these books for the beginner would be Dyke's Auto-

mobile Encyclopedia, the Gasoline Automobile, by Heldt, as an advanced course, and numerous other books which will be supplied by the U.P.C. Co.

DEFINING INERTIA

Q—Advise us how to tighten the drive chain on a Dodge motor generator.

2—Advise how to find the positive or negative terminal on a storage battery.

3—What is meant by inertia?

4—What will cause a coil to overheat?

5—Publish wiring diagram of Model K Grant.—Ernest Bukove, Therma, N. M.

1—You will find complete information for tightening the starter chain in a special article on the Dodge electrical system in the Dec. 1, 1921, issue of MOTOR AGE.

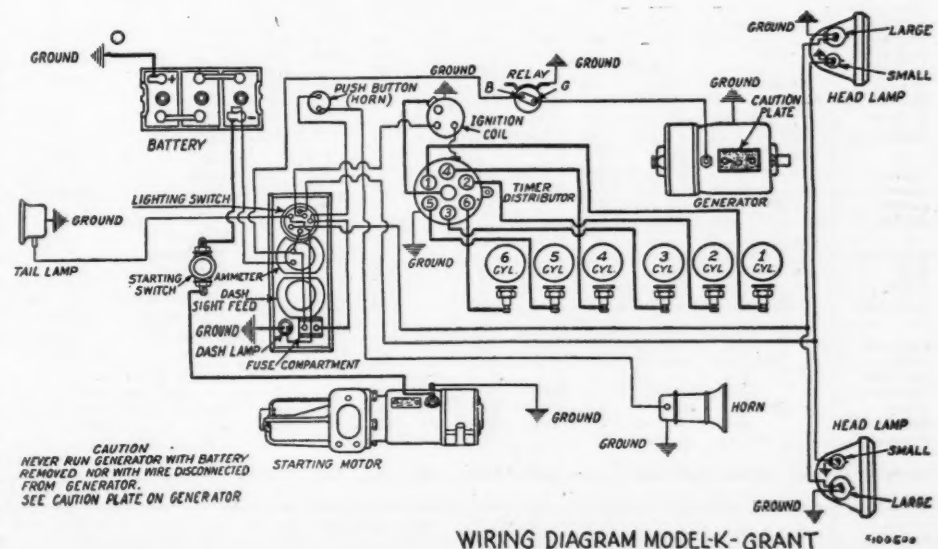
2—If you have a voltmeter available on which one terminal is marked plus you can connect this voltmeter to the battery. If the meter tries to read backwards reverse the connections and then when you have the meter reading in the correct direction see what battery terminal the plus terminal of the voltmeter is connected with. This terminal will be the positive terminal of the battery.

3—Inertia is a property which all material bodies have which tends to keep them either in a state of rest or of uniform motion. For example, a heavy weight suspended by a rope has considerable inertia, that is, it tends to stay in one place or if one should bump against it suddenly the jolt would be considerable in spite of the fact that the weight is suspended and free to move.

Another illustration is the blow received when an object moving at high speed encounters an obstruction, this being due to the inertia or tendency that the object has to keep on going.

4—You do not say what kind of a coil nor under what circumstances the heating is observed, but in general sending too much current to a coil will cause it to overheat, the exact amount depending on the design of the coil.

5—Wiring diagram of the Model K Grant is shown below:



Specifications of Current Passenger Car Models

NAME AND MODEL	Engine Make	Cylinders, Bore and Stroke	WB	Tires	2-Pass.	5-Pass.	7-Pass.	Coupe	Sedan	NAME AND MODEL	Engine Make	Cylinders, Bore and Stroke	WB	Tires	2-Pass.	5-Pass.	7-Pass.	Coupe	Sedan
Ace.....F	G-B	4-3 1/2 x 5	114	32x4	\$1295	\$1295	.....	.....	\$2295	Marmion.....34	Own.	6-3 1/2 x 5 1/2	136	32x4 1/2	\$3700	\$3700	\$3700	\$4700	\$5150
Ace.....L	H-S	4-3 1/2 x 5	117	32x4	2260	2260	.....	.....	3680	Maxwell.....	Own.	4-3 1/2 x 5 1/2	109	31x4	885	885	.....	1385	1485
Ace.....C	Cont.	6-3 1/2 x 5 1/2	126	33x4 1/2	2975	2975	.....	.....	4500	McFarlan.....1921	Own.	6-4 1/2 x 6	140	33x5	6300	6300	6300	7500	7500
Ambassador.....R	Cont.	6-3 1/2 x 5 1/2	136	33x5	.....	14500	\$4500	.....	6500	Mercer.....Series 5	Own.	4-3 1/2 x 5 1/2	132	32x4 1/2	3950	13950	*3950	4850	5250
American.....C	H-S	6-3 1/2 x 5	127	32x4	2195	2195	2250	.....	3150	Merit.....	Cont.	6-3 1/2 x 4 1/2	119	32x4	1895	1895	.....	.....	.....
Anderson.....Series 40	Cont.	6-3 1/2 x 4 1/2	120	33x4	2195	1650	1795	\$2450	2550	Meteor.....R & RR	Dues.	4-4 1/2 x 6	129	32x4 1/2	5000	5000	.....	.....	.....
Apperson.....8-21-S	Own.	8-3 1/2 x 5	130	34x4 1/2	.....	2620	2645	3625	3695	Mitchell.....F-50	Own.	6-3 1/2 x 5	120	33x4	1490	1-90	1600	2050	2275
Auburn Beauty Six 6-51	Cont.	6-3 1/2 x 4 1/2	121	32x4	1575	1575	1615	2275	2395	Mitchell.....F-50	Own.	6-3 1/2 x 5	127	33x4	.....	.....	1600	.....	.....
Auburn Beauty Six	Cont.	6-3 1/2 x 4 1/2	121	32x4 1/2	.....	12195	.....	.....	.....	Monroe.....1922-S-13	Own.	4-3 1/2 x 4 1/2	115	32x3 1/2	875	875	.....	.....	.....
Beggs.....20T	Cont.	6-3 1/2 x 4 1/2	120	33x4	1775	1520	.....	2320	2420	Moon.....6-40	Cont.	6-3 1/2 x 4 1/2	115	31x4	.....	1295	.....	.....	.....
Bell.....4-32	H-S	4-3 1/2 x 5	114	31x4	1195	1195	.....	.....	.....	Moon.....6-48	Cont.	6-3 1/2 x 4 1/2	122	32x4	1785	1785	2285	2785	2785
Bell.....6-50	H-S	4-3 1/2 x 5	124	32x4	1545	1545	.....	.....	.....	Moon.....6-68	Cont.	6-3 1/2 x 5 1/2	125	32x4 1/2	.....	2285	.....	.....	.....
Biddle.....B1 & B3	Buda.	6-3 1/2 x 5 1/2	121	32x4	2050	12950	.....	3950	3950	Murray-Mac Six	Own.	6-3 1/2 x 5 1/2	128	34x4 1/2	4250	4250	4250	.....	.....
Brewster.....91	Own.	4-4 1/2 x 5 1/2	125	32x4 1/2	6000	6000	.....	.....	9200	Nash.....691-96-97	Own.	6-3 1/2 x 5	121	33x4	1360	1390	1540	2090	2390
Buick 1922-31-35-37	Own.	4-3 1/2 x 4 1/2	109	31x4	895	935	.....	1295	1395	Nash.....692-94-95	Own.	6-3 1/2 x 5	127	34x4 1/2	.....	.....	1540	2090	2390
Buick 1922-41-5-6-7	Own.	4-3 1/2 x 4 1/2	118	33x4 1/2	1365	1395	.....	1885	2165	Nash Four.....41-A	Own.	4-3 1/2 x 5	112	33x4	965	985	.....	1485	1645
Buick 1922-18-3-50	Own.	6-3 1/2 x 4 1/2	124	34x4 1/2	1785	.....	1585	2075	2375	National.....BB	Own.	6-3 1/2 x 5 1/2	130	32x4 1/2	2750	12750	2750	3890	3990
Cadillac.....61	Own.	8-3 1/2 x 5 1/2	132	33x5	3100	3150	3150	3925	4100	Noma.....3C	Ben.	6-3 1/2 x 4 1/2	128	32x4 1/2	2000	12100	*2200	.....	3200
Case.....X	Cont.	6-3 1/2 x 5 1/2	126	34x4 1/2	.....	1890	.....	2585	2990	Noma.....1D	Cont.	6-3 1/2 x 5 1/2	128	32x4 1/2	3000	13100	*3200	.....	5500
Case.....V	Cont.	6-3 1/2 x 5 1/2	126	34x4 1/2	.....	1935	.....	2095	2990	Norwalk.....430-KS	Lyc.	4-3 1/2 x 5	116	32x3 1/2	.....	1035	.....	.....	.....
Chalmers.....1922	Own.	6-3 1/2 x 4 1/2	117	32x4	1345	1395	1495	2055	2395	Oakland.....6-44	Own.	6-2 1/2 x 4 1/2	115	32x4	1120	1145	1265	1685	1785
Chalmers.....1922	Own.	6-3 1/2 x 4 1/2	122	32x4	.....	1495	.....	.....	.....	Ogren.....6 T De Luxe	Cont.	6-3 1/2 x 5 1/2	134	33x5	13750	3750	3850	4500	4800
Champion.....Tourist	Lyc.	4-3 1/2 x 5	113	32x3 1/2	.....	995	.....	.....	.....	Oldsmobile.....43-A	Own.	4-3 1/2 x 5 1/2	115	32x4	1145	1145	.....	1645	1795
Champion.....Special	H-S	4-3 1/2 x 5	118	32x4	1095	1095	.....	.....	.....	Oldsmobile.....46	Own.	8-2 1/2 x 4 1/2	122	33x4 1/2	.....	1735	1735	.....	2635
Chandler.....Six	Own.	4-3 1/2 x 5	123	33x4	1595	1595	1695	2295	2395	Oldsmobile.....47	Own.	8-2 1/2 x 4 1/2	115	32x4	1595	1595	.....	2145	2265
Chevrolet.....490	Own.	4-3 1/2 x 5	102	30x3 1/2	525	525	.....	875	875	Overland.....4	Own.	4-3 1/2 x 4	100	30x3 1/2	550	550	.....	850	895
Chevrolet.....FB	Own.	4-3 1/2 x 5 1/2	110	32x4	975	975	.....	1575	1575	Packard.....Single-Six	Own.	6-3 1/2 x 4 1/2	116	33x4 1/2	2350	2350	.....	3125	3350
Cleveland.....41	Own.	6-3 1/2 x 4 1/2	112	32x4	1175	1195	.....	1550	1575	Packard.....Twin Six	Own.	12-3 x 5	136	35x5	3850	3850	3850	5240	5400
Climber Four.....K	H-S	4-3 1/2 x 5	115	33x4	1385	1385	.....	.....	1595	Paige.....6-44	Own.	6-3 1/2 x 5	119	32x4	1465	1465	.....	1995	2245
Climber Six.....S	H-S	6-3 1/2 x 5	125 1/2	32x4 1/2	2250	2250	3000	3100	.....	Paige.....6-66	Cont.	6-3 1/2 x 5	131	33x4 1/2	1245	1245	2195	3100	3155
Cole.....890	Nort.	8-3 1/2 x 4 1/2	127 1/2	33x5	2485	2485	2485	3185	3685	Paterson.....22-6-52	Cont.	6-3 1/2 x 4 1/2	120	32x4 1/2	.....	1550	1585	2595	2595
Columbia Challenger	Int.	6-3 1/2 x 5	115	32x4	.....	1195	.....	1995	1995	Peerless.....5-S-7	Own.	8-3 1/2 x 5	125	34x4 1/2	.....	12790	2790	3500	3790
Columbia.....D-C&CS	Cont.	6-3 1/2 x 4 1/2	115	32x4	1475	1475	11475	12295	2350	Piedmont.....4-30	Lyc.	4-3 1/2 x 5	116	32x3 1/2	.....	970	.....	.....	.....
Columbia.....Light Six	Cont.	6-3 1/2 x 4 1/2	115	31x4	985	985	.....	1295	1395	Piedmont.....6-40	Cont.	6-3 1/2 x 4 1/2	122	32x4	.....	1285	.....	.....	.....
Comet.....C-53	Cont.	6-3 1/2 x 5 1/2	125	33x4 1/2	.....	1085	2085	.....	2085	Pierce-Arrow.....	Own.	6-4 x 5 1/2	138	33x5	7000	6500	6500	8000	8500
Crawford.....22-6-60	Cont.	6-3 1/2 x 5 1/2	122 1/2	32x4	3000	3000	3000	.....	4500	Pilot.....6-45	Teeter	6-3 1/2 x 5	120	32x4	1500	1500	.....	.....	.....
Daniels.....D-19	Own.	8-3 1/2 x 5 1/2	132	34x4 1/2	4350	4350	4350	5250	5950	Pilot.....6-50	H-S	6-3 1/2 x 5	126	32x4 1/2	2050	2050	2050	2950	3000
Davis.....71	Cont.	6-3 1/2 x 4 1/2	114	31x4	.....	1195	.....	.....	.....	Porter.....46	Own.	4-4 1/2 x 6 1/2	142	35x5	6750	6750	6750	.....	7900
Davis.....61-67	Cont.	6-3 1/2 x 4 1/2	120	33x4	1595	1595	11695	2095	2195	Premier.....6-D	Own.	6-3 1/2 x 5 1/2	126 1/2	33x5	3150	13100	3250	.....	5100
Dixie Flyer.....H-S-70	H-S	4-3 1/2 x 5	112	32x4	1095	1095	11295	1545	1595	Premocar.....6-40 A	Falls.	6-3 1/2 x 4 1/2	117	32x4	1095	1095	1195	1750	1825
Dodge Brothers.....	Own.	4-3 1/2 x 4 1/2	114	32x4	850	880	.....	1280	1440	R & V Knight.....R	Own.	4-3 1/2 x 5	116	32x4	.....	1665	.....	2385	2475
Dorris.....6-80	Own.	6-4 x 5	132	33x5	.....	14785	4785	5800	7190	R & V Knight.....Twin Six	Own.	6-3 1/2 x 5 1/2	127	32x4 1/2	2475	12475	2475	3000	3105
Dort.....19-14	L-Ly.	4-3 1/2 x 5	108	31x4	865	865	.....	1315	1445	Reo Series.....B-T6 & U6	Own.	6-3 1/2 x 5	120	33x4	1595	.....	1595	2355	2435
Driggs.....	Own.	4-2 1/2 x 4 1/2	104	30x3 1/2	1275	1275	.....	1975	.....	ReVer.....4-4 1/2 x 6	C Dues.	4-4 1/2 x 6	131	32x4 1/2	3200	3200	3200	.....	4000
Duesenberg.....Straight 8	Own.	8-3 1/2 x 5	134	33x5	6500	6500	6750	7800	7800	Rickenbacker.....A	Own.	6-3 1/2 x 4 1/2	117	32x4	.....	1455	.....	1885	1985
Du Pont.....A	Own.	4-3 1/2 x 5 1/2	124	32x4 1/2	3000	3200	.....	3800	4000	Roamer.....6-54-E	Cont.	6-3 1/2 x 5 1/2	128	32x4 1/2	2850	12850	2785	3850	3850
Durant.....A-22	Cont.	4-3 1/2 x 4 1/2	109	31x4	.....	890	.....	1365	1365	Roamer.....4-75-E	Dues.	4-4 1/2 x 6	128	32x4 1/2	3985	13585	13750	.....	14650
Durant.....B-22	Anst.	6-3 1/2 x 4 1/2	123	32x4 1/2	1600	1650	.....	2250	2400	Rolls-Royce.....	Own.	6-4 1/2 x 4 1/2	143 1/2	33x5	.....	10,900	.....	.....	.....
Earl.....40	Own.	4-3 1/2 x 5 1/2	112	32x4	1485	1185	.....	.....	1895	Romer.....R-22	Cont.	6-3 1/2 x 4 1/2	120	32x4	1975	1975	2050	2400	2700
Elcar.....K-4	Lyc.	4-3 1/2 x 5	118	33x4	1095	1095	1095	1345	.....	Saxon.....125	Own.	4-3 1/2 x 5	112	32x4	1195	1195	.....	1795	1795
Elcar.....7-R	Cont.	6-3 1/2 x 4 1/2	118	33x4	1395	1395	1395	2065	2165	Sayers Six.....DP	Cont.	6-3 1/2 x 4 1/2	118	33x4	1695	1695	.....	2795	2795
Elgin.....K-1	Falls.	6-3 1/2 x 4 1/2	118	33x4	1345	1295	1345	2195	2195	Seneca.....L & O	Lell.	4-3 1/2 x 4 1/2	108	30x3 1/2	815	815	.....	.....	.....
Essex.....	Own.	4-3 1/2 x 5	108 1/2	32x4	1095	1095	.....	1345	1895	Seneca.....50 & 51	Lyc.	4-3 1/2 x 5	112	31x4	1095	1095	.....	.....	.....
Falco, H.P.M.....12-D22	Own.	4-2 1/2 x 4	100	27x3 1/2	2800	13000	.....	.....	4000	Southern Six.....660-2	H-S	6-3 1/2 x 5	127	32x4 1/2	2375	2375	2395	.....	.....
Ferris.....Series 60	Cont.	6-3 1/2 x 5 1/2	130	32x4 1/2	2575	.....	2475	.....	3475	Spiering, A.....	Supr.	4-3 1/2 x 5	114	32x4	980	980	.....	1685	1685
Ferris.....Series 70	Cont.	6-3 1/2 x 5 1/2	130	32x4 1/2	2895	.....	2795	.....	3995	Standard Sterling.....J	Own.	8-3 1/2 x 5	127	34x4 1/2	2500	12500	2500	2750	3200
Ford.....T	Own.	4-3 1/2 x 4	109	30x3 1/2	*3119	1348	.....	580	645	Stanley.....	Own.	2-4 x 5	130	34x4 1/2	2800	2600	2600	3775	3850
Franklin.....9-B	Own.	6-3 1/2 x 4	115	32x4	2400	2450	.....	3200	3450	Stanwood Six.....	Cont.	6-3 1/2 x 4 1/2	118	33x4	1765	1765	.....	2750	.....
Gardner.....T-R & G	Lyc.	4-3 1/2 x 5	117	32x3 1/2	805	895	.....	.....	1595	Star.....	Cont.	4-3 1/2 x 4 1/2	102	30x3 1/2	*319	1348	.....	580	645
Goodspeed.....	Own.	4-3 1/2 x 4 1/2	124	32x4 1/2	3985	3785	.....	.....	.....	Stearns Knight.....SKL4	Own.	4-3 1/2 x 5 1/2	125	34x4 1/2	2250	2250	2450	3150	3450
Grant.....	Own.	6-3 1/2 x 4 1/2	110	32x4	1385	1385	.....	1895	1945	Stevens.....90	Own.	6-3 1/2 x 4 1/2	122	33x4 1/2	1675	17475	17475	2650	2650
H.C.S.....	Weid.	4-3 1/2 x 5 1/2	120	32x4 1/2	2400	2400	.....	2850	3150	Stevens-Duryea.....E	Own.	6-4 1/2 x 5 1/2	138	35x5	7250	6900	.....	18900</	

Specifications of Current Motor Truck Models

NAME AND MODEL	Tons Capacity	Chassis Price	Bore and Stroke	TIRES		Final Drive	NAME AND MODEL	Tons Capacity	Chassis Price	Bore and Stroke	TIRES		Final Drive	NAME AND MODEL	Tons Capacity	Chassis Price	Bore and Stroke	TIRES		Final Drive
				Front	Rear						Front	Rear						Front	Rear	
Acason	3 1/2-1	\$1050	3 1/2 x 5	34x5 1/2	34x5 1/2	W	Concord, A	2	\$3150	4 x 5 1/2	36x3 1/2	36x6	W	Gary, F	1 1/2-1 3/4	\$2600	3 1/2 x 5	36x3 1/2	36x4	W
Acason, RB	1 1/2	1950	3 1/2 x 5 1/2	36x3 1/2	36x6	W	Concord, B	3	3600	4 1/2 x 5 1/2	36x4	36x8	W	Gary, I	2	2900	4 x 5 1/2	36x3 1/2	36x5	W
Acason, H	2 1/2	2750	3 1/2 x 5 1/2	36x3 1/2	36x8	W	Concord, BX	2	3250	4 x 5 1/2	36x3 1/2	36x6	W	Gary, J	2 1/2	3800	4 1/2 x 5 1/2	36x4	36x7	W
Acason, L	3 1/2	3450	3 1/2 x 5 1/2	36x3 1/2	36x10	W	Concord, AX	3	3600	4 1/2 x 5 1/2	36x4	36x8	W	Gary, K	3 1/2	4900	4 1/2 x 5 1/2	36x5	40x5 1/2	W
Acason, M	5	4350	5 x 8 1/2	36x6	40x12	W	Cook, 51	2 1/2	3600	4 x 5 1/2	36x6 1/2	40x8 1/2	W	Gary, M	5	5900	5 x 8 1/2	36x6	40x6 1/2	W
Ace, C	1 1/2	2295	3 1/2 x 5 1/2	34x3 1/2	34x5	W	Corbitt, E-22	1	1480	3 1/2 x 5	34x3 1/2	34x4	W	Gersis, M	1 1/2	3100	4 x 5 1/2	36x3 1/2	36x7	W
Ace, A	2 1/2	2795	3 1/2 x 5 1/2	36x4	36x7	W	Corbitt, D-22	1 1/2	2200	3 1/2 x 5	34x3 1/2	34x4	W	Gersis, K	2 1/2	3500	4 1/2 x 5 1/2	36x4	36x8	W
Acme, G	1 1/2	2795	3 1/2 x 5 1/2	36x4	36x7	W	Corbitt, C-22	2	2600	4 1/2 x 5 1/2	36x3 1/2	36x6	W	Gersis	3 1/2	4500	4 1/2 x 5 1/2	36x5	40x12	W
Acme, B	1 1/2	2795	3 1/2 x 5 1/2	36x4	36x7	W	Corbitt, B-22	2 1/2	3000	4 1/2 x 5 1/2	36x4	36x7	W	Golden West, GH	3	4500	4 1/2 x 5 1/2	36x7	36x7	W
Acme, F	1 1/2	2795	3 1/2 x 5 1/2	36x4	36x7	W	Corbitt, R-22	3	3200	4 1/2 x 5 1/2	36x4	36x8	W	Golden West, G	3 1/2	5000	4 1/2 x 5 1/2	36x6	36x6	W
Acme, A	2 1/2	2795	3 1/2 x 5 1/2	36x4	36x7	W	Corbitt, A-22	3 1/4-4	3400	4 1/2 x 5 1/2	36x5	36x10	W	Graham Bros.	1	1265	3 1/2 x 4 1/2	33x4 1/2	34x5 1/2	I
Acme, AC	2 1/2	2795	3 1/2 x 5 1/2	36x4	36x7	W	Corbitt, AA-22	5	4500	4 1/2 x 5 1/2	36x6	40x6 1/2	W	Graham Bros.	1 1/2	1325	3 1/2 x 4 1/2	33x4 1/2	36x6 1/2	B
Acme, C	3 1/2	2795	3 1/2 x 5 1/2	36x5	40x10	W	Day-Elder, AS	1	1600	3 1/2 x 5	35x5 1/2	35x5 1/2	W	Graham Bros.	1 1/2	1365	3 1/2 x 4 1/2	33x4 1/2	36x6 1/2	B
Acme, E	5	2795	3 1/2 x 5 1/2	36x6	40x12	W	Day-Elder, B	1 1/2	2000	3 1/2 x 5	34x3 1/2	34x5	W	Graham Bros.	1 1/2	1365	3 1/2 x 4 1/2	33x4 1/2	36x6 1/2	B
American, 25	2 1/2	3350	4 x 6	36x4	36x10	W	Day-Elder, D	2	2400	3 1/2 x 5	36x4	36x7	W	Graham Bros.	1 1/2	1365	3 1/2 x 4 1/2	33x4 1/2	36x6 1/2	B
American, 40	4	4275	4 1/2 x 6	36x5	36x10	W	Day-Elder, C	2 1/2	2750	4 1/2 x 5 1/2	36x4	36x7	W	Graham Bros.	1 1/2	1365	3 1/2 x 4 1/2	33x4 1/2	36x6 1/2	B
Apex, G	1	1450	3 1/2 x 5 1/2	34x3 1/2	34x5	W	Day-Elder, E	3 1/2	3150	4 1/2 x 5 1/2	36x5	36x10	W	Graham Bros.	1 1/2	1365	3 1/2 x 4 1/2	33x4 1/2	36x6 1/2	B
Apex, D	1 1/2	1915	3 1/2 x 5 1/2	34x3 1/2	34x5	W	Day-Elder, F	5	4250	4 1/2 x 5 1/2	36x5	40x6 1/2	W	Graham Bros.	1 1/2	1365	3 1/2 x 4 1/2	33x4 1/2	36x6 1/2	B
Apex, E	2 1/2	2895	3 1/2 x 5 1/2	36x4	36x7	W	Dearborn, E	1	1600	3 1/2 x 5	35x5	35x5	W	Graham Bros.	1 1/2	1365	3 1/2 x 4 1/2	33x4 1/2	36x6 1/2	B
Apex, F	3 1/2	3975	3 1/2 x 5 1/2	36x5	36x10	W	Dearborn, FX	1 1/2	2300	3 1/2 x 5	34x4	34x5	W	Graham Bros.	1 1/2	1365	3 1/2 x 4 1/2	33x4 1/2	36x6 1/2	B
Armleder, 20	1	2350	3 1/2 x 5 1/2	34x3 1/2	34x5	W	Dearborn, F	1 1/2	2180	3 1/2 x 5	34x4	34x5	W	Graham Bros.	1 1/2	1365	3 1/2 x 4 1/2	33x4 1/2	36x6 1/2	B
Armleder, 21	1 1/2	2425	3 1/2 x 5 1/2	34x3 1/2	34x5	W	Dearborn, 48	2	2590	3 1/2 x 5	34x4 1/2	34x7	W	Graham Bros.	1 1/2	1365	3 1/2 x 4 1/2	33x4 1/2	36x6 1/2	B
Armleder, 40	1 1/2	2425	3 1/2 x 5 1/2	34x3 1/2	34x5	W	Defiance, G	1	1695	3 1/2 x 5	35x5 1/2	35x5 1/2	W	Hahn, B2	1	1700	3 1/2 x 5	34x5	34x5	W
Armleder, HW	2 1/2	3200	3 1/2 x 5 1/2	36x4	36x7	W	Defiance, D	1 1/2	2095	3 1/2 x 5	35x5 1/2	35x6 1/2	W	Hahn, O	1 1/2	1900	3 1/2 x 5	36x3 1/2	36x6	W
Armleder, KW	3 1/2	4150	3 1/2 x 5 1/2	36x5	36x10	W	Defiance, E	2	2275	3 1/2 x 5	35x5 1/2	35x7 1/2	W	Hahn, K	2	2225	3 1/2 x 5	36x4	36x8	W
Atco, B	1 1/2	2425	3 1/2 x 5 1/2	34x3 1/2	34x5	W	DeMartini, 1 1/2	1 1/2	2600	3 1/2 x 5	34x3 1/2	34x6	W	Hahn, L	3	2900	3 1/2 x 5	36x5	36x10	W
Atco, B1	1 1/2	2425	3 1/2 x 5 1/2	34x3 1/2	34x5	W	DeMartini, 2	2	3300	4 x 5 1/2	36x4	36x7	W	Hahn, M	5	3500	4 1/2 x 5 1/2	36x6	40x12	W
Atco, A	2 1/2	2425	3 1/2 x 5 1/2	34x3 1/2	34x5	W	DeMartini, 3	3	4250	4 1/2 x 5 1/2	36x4	36x10	W	Hahn, N	6	4500	4 1/2 x 5 1/2	36x6	40x12	W
Atlas, M.D.	1	1185	3 1/2 x 5 1/2	32x4 1/2	32x4 1/2	W	DeMartini, 4	4	4800	4 1/2 x 5 1/2	36x5	36x12	W	Hal-Fur, E	2 1/2	3000	4 1/2 x 5 1/2	36x6	36x7	W
Atterbury, 20R	1 1/2	2475	3 1/2 x 5 1/2	34x3 1/2	34x5	W	Denby, 31	1 1/2	1485	3 1/2 x 5	35x5 1/2	35x5 1/2	W	Hal-Fur, F	3 1/2	4000	4 1/2 x 5 1/2	36x6	40x10 1/2	W
Atterbury, 7CX	2 1/2	3175	3 1/2 x 5 1/2	36x4	36x10	W	Denby, 33	2 1/2	2145	3 1/2 x 5	35x5 1/2	35x7 1/2	W	Hal-Fur, B	3 1/2	4000	4 1/2 x 5 1/2	36x6	40x10 1/2	W
Atterbury, 7D	3 1/2	3975	3 1/2 x 5 1/2	36x5	40x10	W	Denby, 34	2	2395	3 1/2 x 5	36x3 1/2	36x6	W	Hall, 1 1/2	1 1/2	3100	3 1/2 x 5	34x5	36x7	W
Atterbury, 8E	5	4975	3 1/2 x 5 1/2	36x5	40x10	W	Denby, 35	2 1/2	2795	4 1/2 x 5 1/2	36x4	36x7	W	Hall, 2 1/2	2 1/2	3275	4 1/2 x 5 1/2	36x4	36x6	W
Autocar, 21UF	1 1/2-2	1950	3 1/2 x 5 1/2	34x3 1/2	34x5	D	Denby, 27	4	3895	4 1/2 x 5 1/2	36x5	36x10	W	Hall, 3 1/2	3 1/2	4100	4 1/2 x 5 1/2	36x5	36x10	W
Autocar, 21UG	1 1/2-2	2050	3 1/2 x 5 1/2	34x3 1/2	34x5	D	Denby, 210	5	4295	4 1/2 x 5 1/2	36x6	40x6 1/2	W	Hall, 5	5	5100	4 1/2 x 5 1/2	36x5	40x6 1/2	W
Autocar, 27H	2	2950	4 x 5 1/2	34x5	36x7	D	Dependable, A	3 1/2-1	1650	3 1/2 x 5 1/2	34x5	36x6	W	Hall, 7 chain	7	5100	4 1/2 x 5 1/2	36x5	40x6 1/2	C
Autocar, 27K2	2	3075	4 x 5 1/2	34x5	36x7	D	Dependable, C	2	2350	3 1/2 x 5 1/2	34x3 1/2	34x5	W	Harvey, WOA	2	2650	4 1/2 x 5 1/2	36x4	34x7	W
Autocar, 26V	5	3350	4 1/2 x 5 1/2	34x6	36x12	D	Dependable, D	2 1/2	2650	4 x 5 1/2	34x5	36x6	W	Harvey, WFA	2 1/2	2950	4 1/2 x 5 1/2	36x4	36x7	W
Autocar, 26-B	5	4100	4 1/2 x 5 1/2	34x6	36x12	D	Dependable, E	3	2950	4 1/2 x 5 1/2	36x4	36x7	W	Harvey, WHA	2 1/2	3950	4 1/2 x 5 1/2	36x5	36x10	W
Available, H1 1/2	1 1/2	2175	1 x 5 1/2	36x3 1/2	36x5	W	Diamond T, O-3	1-1 1/2	1975	3 1/2 x 5 1/2	36x3 1/2	36x4 1/2	W	Hawkeye, K	1 1/2	1850	3 1/2 x 5 1/2	34x3 1/2	34x5	I
Available, H2 1/2	2 1/2	2775	1 x 5 1/2	36x3 1/2	36x5	W	Diamond T, FS	1 1/2	2935	3 1/2 x 5 1/2	36x3 1/2	36x5	W	Hawkeye, M	2 1/2	2650	3 1/2 x 5 1/2	36x4	36x6	I
Available, H2 1/2	2 1/2	3165	1 x 5 1/2	36x3 1/2	36x5	W	Diamond T, T	1 1/2	2250	3 1/2 x 5 1/2	36x3 1/2	36x5	W	Hawkeye, N	3 1/2	3700	4 1/2 x 5 1/2	36x5	36x10	I
Available, H3 1/2	3 1/2	4175	1 x 5 1/2	36x3 1/2	36x5	W	Diamond T, U	2	2650	4 x 5 1/2	36x4	36x7	W	Hendrickson, O	1 1/2	2000	3 1/2 x 5 1/2	36x4	36x5 1/2	W
Available, H5	5	5375	1 x 5 1/2	36x3 1/2	36x5	W	Diamond T, K	3 1/2	3750	4 1/2 x 5 1/2	36x5	36x10	W	Hendrickson, N	2 1/2	2890	4 1/2 x 5 1/2	36x4	36x7	W
Avery	1	1950	3 1/2 x 5 1/2	34x3 1/2	34x5	I	Diamond T, EL	5	4325	4 1/2 x 5 1/2	36x6	40x6 1/2	W	Hendrickson, M	3 1/2	3000	4 1/2 x 5 1/2	36x5	36x10	W
Beck, A Jr.	1	1950	3 1/2 x 5 1/2	34x3 1/2	34x5	I	Diamond T, S	5	4500	4 1/2 x 5 1/2	36x6	40x6 1/2	W	Hendrickson, K	5</					

Specifications of Current Motor Truck Models—Continued

NAME AND MODEL	Tons Capacity	Chassis Price	Bore and Stroke	TIRES		Final Drive	NAME AND MODEL	Tons Capacity	Chassis Price	Bore and Stroke	TIRES		Final Drive	NAME AND MODEL	Tons Capacity	Chassis Price	Bore and Stroke	TIRES		Final Drive
				Front	Rear						Front	Rear						Front	Rear	
Kimball, AF	5	\$5500	5 x 6	36x6	40x7d	W	O. K., M1	3 1/2	\$4250	4 1/2 x 6	36x5	36x5d	W	Signal, J	2 1/2	\$2875	4 1/2 x 5 1/2	34x4	36x8	W
Kissel, Express	1	1935	3 1/2 x 5 1/2	34x5 1/2	34x5 1/2	W	Ogden, D	1 1/2	....	3 1/2 x 5	36x3 1/2	36x5	W	Signal, M	3 1/2	3675	4 1/2 x 5 1/2	36x5	40x5d	W
Kissel, Utility	1 1/2	1975	3 1/2 x 5 1/2	36x3 1/2	36x5	W	Ogden, D	1 1/2	....	3 1/2 x 5	36x3 1/2	36x5	W	Signal, R	5	4400	4 1/2 x 6	36x6	40x6d	W
Kissel, Freight	2 1/2	2875	4 1/2 x 5 1/2	36x4	36x7	W	Ogden, E	2 1/2	....	4 1/2 x 5 1/2	36x4	36x8	W	Southern, 10	1	2090	3 1/2 x 5	34x3 1/2	34x4	W
Kissel, H. D.	4	3675	4 1/2 x 5 1/2	36x5	36x5d	W	O. J. Hickory, W	1	1775	3 1/2 x 5	36x3 1/2	36x4*	W	Southern, 15	1 1/2	2590	3 1/2 x 5 1/2	36x6 1/2	34x4	W
Kleiber, AA	1 1/2	2200	4 1/2 x 5 1/2	31x3 1/2	34x5*	W	Old Reliable, A	1 1/2	2350	4 x 5	34x4	36x6	W	Southern, 20	2	2990	4 1/2 x 5 1/2	36x6 1/2	40x8*	W
Kleiber, BB	2 1/2	3100	4 1/2 x 5 1/2	36x3 1/2	36x6*	W	Old Reliable, B	2 1/2	3500	4 1/2 x 6	34x4	36x4d	W	Standard, 1-K	1 1/2	1600	3 1/2 x 5	34x3 1/2	34x5*	W
Kleiber, B	2 1/2	3600	4 1/2 x 5 1/2	36x4*	36x7*	W	Old Reliable, C	3 1/2	4250	4 1/2 x 6	36x5	36x5d	W	Standard, 76	2 1/2-3	2400	4 1/2 x 5 1/2	36x4*	36x7*	W
Kleiber, C	3 1/2	3950	4 1/2 x 5 1/2	36x5*	36x8	W	Old Reliable, D	5	5250	4 1/2 x 6	36x6	40x6d	W	Standard, 66	3 1/2-5	3150	4 1/2 x 5 1/2	36x5	36x10	W
Kleiber, D	5	4800	4 1/2 x 5 1/2	36x5	36x5d	W	Old Reliable, KLM	7	6000	4 1/2 x 6 1/2	36x6	40x7d	C	Standard, 5-K	5-7	4400	4 1/2 x 6	36x6	40x12	W
Koehler, D	1 1/2	5300	5 x 6 1/2	36x6	40x12	W	Oldsmobile Econ.	1	1095	3 1/2 x 5 1/2	35x5 1/2	35x5 1/2	W	Sterling, 1 1/2	1 1/2	2885	4 x 5 1/2	36x3 1/2	36x5*	W
Koehler, D	2 1/2	1995	3 1/2 x 5	34x3 1/2	34x5	W	Olympic, A	2 1/2	3200	3 1/2 x 5	36x4	36x8	W	Sterling, 2	2	3085	4 x 5 1/2	36x4	36x6*	W
Koehler, D	2 1/2	3175	4 x 5 1/2	36x4	36x7	W	Oaksh, A	2	3750	3 1/2 x 5	36x6 1/2	36x6 1/2	4	Sterling, 2 1/2	2 1/2	3290	4 1/2 x 5 1/2	36x4*	36x4d*	W
Koehler, MCS	2 1/2	3275	4 x 5 1/2	36x4	36x7	W	Oaksh, AA	2	3850	3 1/2 x 5	36x6 1/2	36x6 1/2	4	Sterling, 3 1/2	3 1/2	4325	4 1/2 x 5 1/2	36x5*	40x5d*	W
Koehler, F	3 1/2	4150	4 1/2 x 5 1/2	36x5	36x10	W	Oaksh, BB	2 1/2	4150	4 x 5 1/2	36x7	36x7	4	Sterling, 5-W	5	4950	5 x 1 1/2	36x6*	40x6d*	W
Koehler, MT, Trac	2 1/2	3275	4 x 5 1/2	36x4	36x7	W	Oaksh, BB	2 1/2	4300	4 x 5 1/2	36x7	36x7	4	Sterling, 5-C	5	5500	5 x 1 1/2	36x6	40x6d	C
Lange, B	2 1/2	3350	4 1/2 x 5 1/2	36x4*	36x7*	C	Packard, EC	1 1/2-3	3100	4 1/2 x 5 1/2	36x4	36x7	W	Sterling, 7 1/2	7 1/2	6000	5 x 1 1/2	36x6	40x7d	C
Larrabee, X-Z	1	1925	3 1/2 x 4 1/2	34x5 1/2	34x5 1/2	B	Packard, ED	1 1/2-3	3100	4 1/2 x 5 1/2	36x6 1/2	40x8 1/2	W	Stewart, 14	1 1/2	1195	3 1/2 x 5 1/2	32x4 1/2	32x4 1/2	I
Larrabee, U	1 1/2	2400	3 1/2 x 5	34x3 1/2	34x5	B	Packard, EX	2 1/2-4 1/2	4100	4 1/2 x 5 1/2	36x5	36x5d	W	Stewart, 15	1 1/2	1395	3 1/2 x 5 1/2	35x5 1/2	35x5 1/2	I
Larrabee, J	1 1/2-2 1/2	2400	3 1/2 x 5	34x3 1/2	34x5*	W	Packard, EF	4 1/2-7 1/2	4500	5 x 5 1/2	36x6	40x6d	W	Stewart, 9	1 1/2	1790	3 1/2 x 5	34x3 1/2	34x5	I
Larrabee, K	2 1/2	3100	4 1/2 x 5 1/2	36x4	36x7	W	Paige, 52-19	1 1/2	1950	4 x 5 1/2	34x3 1/2	34x5	W	Stewart, 7	2	2090	4 1/2 x 5 1/2	34x4	34x7	I
Larrabee, K-5	2 1/2-3	3450	4 1/2 x 5 1/2	36x4	36x8	W	Paige, 54-20	2 1/2	2420	4 1/2 x 5 1/2	34x4	34x8	W	Stewart, 7-X	2 1/2	2290	4 1/2 x 5 1/2	34x4	34x7	I
Larrabee, L-4	3 1/2	4000	4 1/2 x 5 1/2	36x5	36x5 1/2	W	Paige, 51-18	3 1/2	3145	4 1/2 x 5 1/2	36x5	36x5d	W	Stewart, 10	3 1/2	3090	4 1/2 x 5 1/2	36x5	36x5d	I
Larrabee, L-5	3 1/2-5	4400	4 1/2 x 6	36x5	36x10	W	Parker, F20	2	3500	4 x 6	34x4	36x4d	W	Stewart, 10-X	3 1/2	3850	4 1/2 x 6	36x5	36x5d	I
Larrabee, W	5	4900	4 1/2 x 6	36x6	40x6d	W	Parker, J20	3 1/2	4400	4 1/2 x 6	36x5	40x5d	W	Stoughton, C	3 1/2	1240	3 1/2 x 5	34x4 1/2	34x4 1/2	W
Luedinghaus, C	1	1090	3 1/2 x 5	35x5 1/2	35x5 1/2	W	Parker, M20	5	5500	4 1/2 x 6	36x6	40x6d	W	Stoughton, F	1	1790	3 1/2 x 5 1/2	34x4 1/2	35x5 1/2	W
Luedinghaus, W	1 1/2	2490	3 1/2 x 5 1/2	34x3 1/2	34x5*	W	Patriot, Revere	1	1500	3 1/2 x 5	35x5 1/2	35x5 1/2	W	Stoughton, B	1 1/2	2150	4 1/2 x 5 1/2	36x3 1/2	36x5	W
Luedinghaus, K	2 1/2-5	2790	4 1/2 x 5 1/2	36x4*	36x7*	W	Patriot, Lincoln	2	2050	4 x 5 1/2	34x3 1/2	34x5	W	Stoughton, D	2	2490	4 x 5 1/2	36x4	36x7	W
Maccari, L	1 1/2	2700	4 1/2 x 5 1/2	36x4	36x6	W	Patriot, Washg'tn	3	2900	4 1/2 x 5 1/2	36x4	36x7	W	Stoughton, E	3	3150	4 1/2 x 5 1/2	36x5d	36x5d	W
Maccari, H-A	2	3100	4 1/2 x 5 1/2	36x4	36x4d	W	Piedmont, 4-30	1	1200	3 1/2 x 5	34x4 1/2	34x4 1/2	W	Sullivan, H	2	2800	4 1/2 x 5 1/2	36x4*	36x7*	W
Maccari, H-2	3	3400	4 1/2 x 5 1/2	36x4	36x5d	W	Pierce-Arrow	2	3200	4 x 5 1/2	36x4	36x4d	W	Sullivan, E	3 1/2	3750	4 1/2 x 6	36x5	36x5d	W
Maccari, H-3	4	4200	4 1/2 x 5 1/2	36x5	36x6d	W	Pierce-Arrow	3 1/2	4350	4 1/2 x 6 1/2	36x5	36x5d	W	Superior, D	1	1650	3 1/2 x 5	34x4 1/2	34x4	I
Maccari, G	5-6	4950	4 1/2 x 6	36x5	40x6d	W	Pierce-Arrow	5	4850	4 1/2 x 6 1/2	36x5	40x6d	W	Superior, E	2	2600	4 1/2 x 5 1/2	36x4	36x6	I
MacDonald, A	7 1/2	5750	4 1/2 x 6	40x7	40x14	I	Pioneer, 59	1	1550	3 1/2 x 4 1/2	32x4 1/2	32x4 1/2	W	Super Truck, 50	2 1/2	3300	4 x 6	36x4	36x8	W
Mack, AB D.R.	1 1/2	3150	4 x 5	36x4	36x3 1/2	D	Pittsburgher	1 1/2-2	3000	4 1/2 x 5 1/2	36x4	36x6	W	Super Truck, 70	3 1/2	4300	4 1/2 x 6	36x5	40x5d	W
Mack, AB Chain	1 1/2	3000	4 x 5	36x4	36x3 1/2	D	Pittsburgher	3	3800	4 1/2 x 5 1/2	36x5*	36x8	W	Super Truck, 100	5	5300	4 1/2 x 6	36x5	40x12	W
Mack, AB Chain	2	3300	4 x 5	36x4	36x4d	C	Power, F	2	3150	4 1/2 x 5 1/2	36x5	36x7	W	Super Truck, 150	7 1/2	6300	5 x 6	36x5	40x7d	W
Mack, AB D.R.	2	3750	4 x 5	36x4	36x4d	D	Power, C	3 1/2	4250	4 1/2 x 5 1/2	36x5	40x10	W	Texas, A38	1 1/2	1095	3 1/2 x 5	33x4	33x4	I
Mack, ABD R	2 1/2	3850	4 x 5	36x4	36x4d	D	Premcar, R-143	1 1/2	2475	3 1/2 x 5	36x6 1/2	36x6 1/2	W	Texas, TK39	1 1/2	1550	3 1/2 x 5	36x6	36x7	W
Mack, AB	2 1/2	3400	4 x 5	36x4	36x4d	C	Rainier, R-21	1 1/2	1990	3 1/2 x 5	35x5 1/2	35x5 1/2	W	Thornhill-Speck	1 1/2	1795	4 x 5 1/2	34x5	34x5	B
Mack, AC Chain	3 1/2	4950	5 x 6	36x5	40x5d	C	Rainier, R-19	1 1/2	2150	3 1/2 x 5	34x3 1/2	34x4	W	Tiffin, GW	1 1/2	2100	4 1/2 x 5 1/2	36x3 1/2	36x5	W
Mack, AC Chain	5	5500	5 x 6	36x6	40x6d	C	Rainier, R-16	1 1/2	2490	3 1/2 x 5	34x3 1/2	34x5	W	Tiffin, MW	2 1/2	2700	4 1/2 x 5 1/2	36x4	36x3 1/2	W
Mack, AC Chain	6 1/2	5750	5 x 6	36x6	40x12	C	Rainier, R-18	2	2890	4 1/2 x 5 1/2	34x4	34x6	W	Tiffin, PW	2 1/2	3600	4 1/2 x 5 1/2	36x5	40x6d	W
Mack, AC Chain	7 1/2	6000	5 x 6	36x7	40x7d	C	Rainier, R-20	2 1/2	3550	4 1/2 x 5 1/2	34x4	34x7	W	Tiffin, F50	5	4300	4 1/2 x 6	36x6	40x6d	W
Mack Trac, AC	5	3400	1 x 5	36x4	36x4d	C	Rainier, R-15	3 1/2	4400	4 1/2 x 5 1/2	36x5	36x5d	W	Tiffin, F60	6	4500	4 1/2 x 6	36x6	40x12	W
Mack Trac, AC	7	4950	5 x 6	36x5	40x5d	C	Rainier, R-17	5	5100	4 1/2 x 6	36x6	36x6d	W	Titan	2	2950	4x5 1/2	34x4*	36x7*	I
Mack Trac, AC	10	5500	5 x 6	36x6	40x6d	C	Ranger, TK-22-2	2	2775	3 1/2 x 5	36x6 1/2	38x7	W	Titan	3 1/2	3050	4 1/2 x 5 1/2	36x5	40x10	I
Mack Trac, AC	13	5750	5 x 6	36x6	40x12	C	Reo, F	3 1/2-11	1245	4 1/2 x 5 1/2	34x4 1/2	34x4 1/2	W	Titan	5	4550	4 1/2 x 6	36x5	40x6d	I
Mack Trac, AC	15	6000	5 x 6	36x7	40x7d	C	Reliance, 10A	1 1/2	2400	4 x 5 1/2	36x3 1/2	36x5	I	Titan, 6-Ton	6	5150	4 1/2 x 6	36x5	40x12	I
Mapleleaf, AA**	2	3775	4 x 5 1/2	36x4	36x7	W	Reliance, 20B	2 1/2	3100	4 1/2 x 5 1/2	36x4	36x4d	I	Tower, J	1 1/2	2900	4 1/2 x 5 1/2	36x5	36x7	W
Mapleleaf, BB**	3	4350	4 1/2 x 5 1/2	36x4	36x4d	W	Republic, 75	2 1/2	1395 1/2	3 1/2 x 5	32x4 1/2	32x4 1/2	I	Tower, H	1 1/2	3200	4 1/2 x 5 1/2	36x4	36x7	W
Mapleleaf, CC**	4	5100	4 1/2 x 5 1/2	36x5	36x5d	W	Republic, 10	1	1395	3 1/2 x 5	34x3	34x4	I	Tower, G	3 1/2	4100	4 1/2 x 5 1/2	36x5	36x5d	W
Mapleleaf, DD**	5	6200	4 1/2 x 5 1/2	36x6	40x6d	W	Republic, 10Exp.	1	1695	3 1/2 x 5	35x5 1/2	34x5 1/2	I	Tower, C	...	1595	3 1/2 x 5	34x3 1/2	34x5*	I
Master, JW	1 1/2	2200	4 1/2 x 5 1/2	34x3 1/2	34x5	W	Republic, 11X	1 1/2	1795	3 1/2 x 5	34x3 1/2	34x6	I	Tower, C	3	1895	3 1/2 x 5	36x4	36x7	I
Master, JD	1 1/2	2500	4 1/2 x 5 1/2	34x3 1/2	34x5	D	Republic, 19	2 1/2	2195	3 1/2 x 5	36x4	36x7	I	Transport, 20	1	1395	3 1/2 x 5 1/2	36x4	36x7	I
Master, Z	2	2200	4 1/2 x 5 1/2	34x3 1/2	34x5	W	Republic, 20	3 1/2	3095	4 1/2 x 5 1/2	36x5	36x10	I	Transport, 30	1 1/2	1905	3 1/2 x 5	36x3 1/2	36x5	I</

Specifications of Current Motor Truck Models—Continued

NAME AND MODEL	Tons Capacity	Chassis Price	Bore and Stroke	TIRES		Final Drive	NAME AND MODEL	Tons Capacity	Chassis Price	Bore and Stroke	TIRES		Final Drive	NAME AND MODEL	Tons Capacity	Chassis Price	Bore and Stroke	TIRES		Final Drive
				Front	Rear						Front	Rear						Front	Rear	
Walter, S	5	\$4850	4 1/2 x 6 1/2	36x6	40x6 1/2	W	Wichita, RX	3	\$3200	4 1/2 x 5 1/2	36x4*	36x8*	W	Winther, 39	1 1/2	\$2450	3 3/4 x 5	34x3 1/2	34x5	1
Ward-LaF., 2B	2 1/2	2990	4 1/2 x 6 1/2	36x4	36x4 1/2	W	Wichita, O	4	3500	4 1/2 x 6 1/2	36x5*	36x5 1/2	W	Winther, 49	2	3250	4 1/2 x 5	34x4	34x4 1/2	1
Ward-LaF., 4A	3 1/2	3990	4 1/2 x 6 1/2	36x5	36x5 1/2	W	Wilcox, AA	1	1900	3 1/2 x 5 1/2	36x4*	36x4*	W	Winther, 50	2 1/2	3995	4 1/2 x 6	38x7 1/2	42x1 1/2	1
Ward-LaF., 5A	5	4590	5 x 6 1/2	36x6	40x6 1/2	W	Wilcox, BB	1 1/2	2550	4 1/2 x 5 1/2	36x4*	36x4*	W	Winther, 70	3 1/2	4 00	4 1/2 x 6	36x5	36x5 1/2	1
Watson, B	1	1685	3 1/2 x 5 1/2	35x5 1/2	35x5 1/2	W	Wilcox, D	2 1/2	3000	4 1/2 x 5 1/2	36x4	36x5	W	Winther, 450	3 1/2	3690	4 1/2 x 5	34x5	36x6	1
Watson, N	3 1/2	3825	4 1/2 x 5 1/2	36x5 1/2	36x10	W	Wilcox, E	3 1/2	3950	4 1/2 x 5 1/2	36x5*	36x5 1/2	W	Winther, 109	5	5250	4 1/2 x 6	36x6	40x5 1/2	1
Western, W1 1/2	1 1/2	2550	4 1/2 x 5 1/2	36x3 1/2*	36x5*	W	Wilson, F	5	4350	4 1/2 x 6 1/2	36x5	40x6 1/2	W	Winther, 140	6 1/2	5930	5 x 6	36x6	40x7 1/2	1
Western, L1 1/2	1 1/2	2550	4 1/2 x 5 1/2	36x3 1/2*	36x5*	W	Wilson, F	5	4350	4 1/2 x 6 1/2	36x5	40x6 1/2	W	Winther, 140	6 1/2	5930	5 x 6	36x6	40x7 1/2	1
Western, W2 1/2	2 1/2	3250	4 1/2 x 5 1/2	36x4	36x7	W	Wilson, F	5	4350	4 1/2 x 6 1/2	36x5	40x6 1/2	W	Winther, 140	6 1/2	5930	5 x 6	36x6	40x7 1/2	1
Western, L2 1/2	2 1/2	3250	4 1/2 x 5 1/2	36x4	36x7	W	Wilson, G	3 1/2	3085	4 1/2 x 5 1/2	36x5	36x5	W	Wisconsin, A	1	1750	3 1/2 x 5	34x5 1/2	34x5 1/2	W, B
Western, W3 1/2	3 1/2	4250	4 1/2 x 5 1/2	36x5	40x5 1/2	W	Wilson, EA	2 1/2	2825	4 1/2 x 5 1/2	36x4	36x7	W	Wisconsin, B	1 1/2	2100	3 1/2 x 5	34x5	36x6	W
White, 15	1 1/2	2400	3 1/2 x 5 1/2	34x5 1/2	34x5 1/2	B	Wilson, G	3 1/2	3085	4 1/2 x 5 1/2	36x5	36x5	W	Wisconsin, C	2 1/2	2700	4 1/2 x 5 1/2	36x6	36x7	W
White, 20	2	3250	3 1/2 x 5 1/2	36x4	36x7	D	Wilson, H	5	4520	4 1/2 x 5 1/2	36x6	40x6	W	Wisconsin, D	3 1/2	3090	4 1/2 x 5 1/2	36x6	36x10	W
White, 40	3 1/2	4200	3 1/2 x 5 1/2	36x5	40x5 1/2	D	Winther, 751	1	1795	3 1/2 x 5	34x4 1/2	35x5	I	Wisconsin, E	5	3500	4 1/2 x 6 1/2	36x6	36x10	W
White, 45	5	4500	4 1/2 x 5 1/2	36x6	40x6 1/2	D	Winther, 430	1 1/2	2850	3 3/4 x 5	32x4	32x4	I	Wisconsin, F	7	4000	5 x 6 1/2	36x6	36x12	W
White Hick., E	1	1225	3 1/2 x 5	34x5 1/2	34x5 1/2	D								Witt-Will, N	1 1/2	2250	3 1/2 x 5	36x3 1/2*	36x5*	W
White Hick., H	1 1/2	1375	3 1/2 x 5	34x5 1/2	34x5 1/2	D								Witt-Will, P	2 1/2	2750	4 1/2 x 5 1/2	36x3 1/2*	36x7*	W
White Hick., K	2 1/2	1675	4 1/2 x 5 1/2	36x4	36x5	W								Wolverine, J	1	2125	3 1/2 x 5	34x3	34x4	1
Wichita, K	1	1875	3 1/2 x 5 1/2	36x3 1/2	36x4	W								Wolverine, J	1 1/2	2375	3 1/2 x 5	34x3 1/2	34x5	1
Wichita, M	2	2400	3 1/2 x 5 1/2	36x3 1/2	36x4	W								Wolverine, J	2	2640	3 1/2 x 5	34x4	34x7	1
														Wolverine, J	2 1/2	3425	4 1/2 x 5 1/2	36x5	36x10	1
														Wolverine, L	3 1/2	4100	4 1/2 x 5 1/2	36x5	36x10	1

*2-cyl. 70-cyl. 13-cyl. All others, not marked, are 4-cyl.
Trac., Tractor. **Canadian made.
Final Drive: W—Worm, L—Internal Gear, C—Chains, D—Double Reduction, B—Bevel, 4—Four-Wheel, E—External Gear. *Tires—optional. †Pneumatic Tires. All others solid.
†Price includes body. ‡—Price includes several items of equipment.

*2-cyl. †6-cyl. ‡3-cyl. All others, not marked, are 4-cyl.
Trac. Tractor. **Canadian made.
Final Drive: W—Worm, I—Internal Gear, C—Chains, D—Double Reduction, B—Bevel, 4—Four-Wheel, E—External Gear. †Tires—optional. ‡Pneumatic Tires. All others solid.
†Price includes body. §—Price includes several items of equipment.

Farm Tractor Specifications and Prices

TRADE NAME	Rating	Price	Wheels or Crawlers	Engine	Cylinders: Bore, Stroke	Fuel	Flow Capacity	TRADE NAME	Rating	Price	Wheels or Crawlers	Engine	Cylinders: Bore, Stroke	Fuel	Flow Capacity	TRADE NAME	Rating	Price	Wheels or Crawlers	Engine	Cylinders: Bore, Stroke	Fuel	Flow Capacity	
All-In One	15-30	\$1975	3	Weid.	4-4 x 5 1/2	GDK	2-3	Frick	12-20	.....	4	Erld.	4-4 x 6	G, K	2-3	Pioneer	40-75	\$3550	4	Own	4-7 x 8	Gas.	10
Allis-Chalm. B	6-12	.....	2	LeR.	4-3 1/2 x 5 1/2	Gas.	1	Frick	15-28	.....	4	Beav.	4-4 1/2 x 6	G, K	3-4	Plowman	15-30	1295	4	Own	4-4 1/2 x 6	G, K	3-4
Allis-Chalm. G.P.	15-25	1350	2	Midw.	4-4 1/2 x 5 1/2	Gas.	1	Grain Belt	18-36	\$2150	4	Wauk	4-4 1/2 x 6 1/2	G or K	4	Ranger Cul.	8-16	.....	4	LeR.	4-3 1/2 x 4 1/2	Gas.	1
Allis-Chalm. 20	20-35	1885	4	Own	4-4 1/2 x 5 1/2	GorK	3-4	Gray	18-36	2000	3	Wauk	4-4 1/2 x 6 1/2	Gas.	4	Reliable	10-20	685	4	Own	2-6 x 7	Ker.	2	
Allis-Chalm. 20-35	20-35	2085	4	Own	4-4 1/2 x 5 1/2	G, K	4	Ground Hog	19-31	2000	4	Erld.	4-4 x 6	G or K	3	Rex	12-25	1600	4	Wauk	4-4 1/2 x 5 1/2	G or K	3	
Allwork	14-28	1695	4	Own	4-4 x 6	GorK	3	Gt. Western St	20-30	1950	4	Beav.	4-4 1/2 x 6	K	4	Russell	12-24	1500	4	Own	4-4 1/2 x 5 1/2	G or K	2-3	
Allwork 2-G	14-28	1395	4	Own	4-5 x 6	GorK	3	Hart-Parr	20	945	4	Own	2-5 1/2 x 6 1/2	K, D	2	Russell	15-30	2200	4	Own	4-5 x 6 1/2	G or K	3-4	
Andrews-Kin.D	18-36	2500	4	Clim.	4-5 x 6 1/2	GorK	4	Hart-Parr	30	1295	4	Own	2-6 1/2 x 7	K, D	3	Russell	20-35	3000	4	Own	4-5 1/2 x 7	G or K	4-5	
Appleton	12-20	1500	4	Buda	4-4 1/2 x 5 1/2	G, K	2-3	Heider	9-16	870	4	Wauk	4-4 1/2 x 6 1/2	G, K	3	Samson	.....	445	4	Own	4-4 x 5 1/2	G, K	2
ARO	3-5	385	4	Own	1-4 1/2 x 5	Gas.	1	Heider	12-20	900	4	Wauk	4-4 1/2 x 6 1/2	G, K	3	Sandusky	10-20	1250	4	Own	4-4 1/2 x 5 1/2	G, K, D	2	
Aultman-T	15-30	2200	4	Clim.	4-5 x 6 1/2	G, K	4	Heider	5-10	800	4	LeR.	4-3 1/2 x 5 1/2	Gas.	1	Sandusky	15-35	1750	4	Own	4-5 x 6 1/2	G, K, D	4	
Aultman-T	22-45	3420	4	Own	4-5 1/2 x 6	G, K	4	Huber Light 4	12-25	1185	4	Wauk	4-4 1/2 x 6 1/2	G or K	3	Shelby	15-30	.....	4	Beav.	4-4 1/2 x 6	G, K	3
Aultman-T	30-60	4500	4	Own	4-7 x 9	G, K, D	9-10	Huber Super 4	15-30	1885	4	Midw.	4-4 1/2 x 6	Gas.	3	Shelby	9-18	.....	4	Wauk	4-3 1/2 x 5 1/2	G or K	2
Automot. B-3	12-21	1785	4	Here.	4-4 x 5 1/2	Gas.	2-3	Illinois Super	15-30	.....	4	Clim.	4-5 x 6 1/2	G, K	4	Short Turn	20-40	1500	3	Beav.	4-4 1/2 x 6	G, K	3
Avery, SR, Cul	5-10	.....	4	Own	4-3 x 4	G, K	2	Imperial	40-70	4500	4	Own	4-7 1/2 x 9	G, K, D	10	Steady Pull	12-21	1485	4	Own	4-4 x 5	Gas.	3
Avery, Cult-C	.....	.....	3	Own	6-3 x 4	G, K	.....	Indiana	5-10	665	2	LeR.	4-3 1/2 x 5 1/2	Gas.	1-2	Stinson	18-36	1835	4	Beav.	4-4 1/2 x 6	G, K	4
Avery	5-10	.....	4	Own	4-3 x 4	G, K	2	International	8-16	1670	4	Own	4-4 1/2 x 6	G, K, D	2	Toga	15-27	1985	4	Wise.	4-4 1/2 x 6	Gas.	3-4
Avery	8-16	.....	4	Own	2-5 1/2 x 6	G, K, D	2-3	International	10-20	1700	4	Own	4-5 1/2 x 8	G, K, D	4	Topp	.....	.....	.....	.....	.....	.....	.....
Avery	12-20	.....	4	Own	4-4 1/2 x 6	G, K, D	3-4	Internat. Titan	15-30	1500	2	Own	4-4 1/2 x 6	G, K, D	3	Stewart	30-45	3500	4	Wauk	4-4 1/2 x 6 1/2	Gas.	3-4
Avery	12-25	.....	4	Own	4-4 1/2 x 6	G, K, D	3-4	J-T	20-40	.....	2	Chief	4-4 1/2 x 6	G, K, D	3-4	Toro Cultivator	6-10	750	3	LeR.	4-3 1/2 x 4 1/2	Gas.	2
Avery	14-28	.....	4	Own	4-5 1/2 x 6	G, K, D	4-5	Klumb	18-32	950	4	Clim.	4-5 x 6 1/2	Gas.	4-6	Toro Tractor 22	6-10	495	3	LeR.	4-3 1/2 x 4 1/2	Gas.	2
Avery	18-36	.....	4	Own	4-6 1/2 x 7	G, K, D	5-6	Knudsen 1920	25-45	2000	4	Own	4-5 1/2 x 6	Gas.	4-6	Townsend	10-20	750	2	Own	4-6 1/2 x 7	Ker.	2-3
Avery	25-50	.....	4	Own	4-7 1/2 x 8	G, K, D	8-10	LaCrosse	6-12	650	4	Own	2-4 x 6	G, K	1	Townsend	15-30	1350	2	Own	4-7 x 8	Ker.	3-4
Avery	45-65	.....	4	Own	4-7 1/2 x 8	G, K, D	8-10	LaCrosse	12-24	985	4	Own	2-6 x 7	G or K	3	Townsend	25-50	2500	2	Own	4-8 x 10	Ker.	4-8
Bates	15-25	.....	4	Own	4-4 1/2 x 6	Ker.	3	Lauson	5-12	1495	4	Midw.	4-4 1/2 x 6 1/2	Gas.	3	Traction Motor	40-50	.....	4	Own	8-3 1/2 x 5	Gas.	4-5
Bates Mule, H	15-25	4	Midw.	4-4 1/2 x 5 1/2	Gas.	3	Lauson	20	1525	1985	4	Beav.	4-4 1/2 x 6	G or K	3-4	Traylor	6-12	715	4	LeR.	4-3 1/2 x 4 1/2	Gas.	1-2
Bates Mule, F	18-25	2	Midw.	4-4 1/2 x 6	Gas.	3	Lauson	21	1535	1985	4	Beav.	4-4 1/2 x 6	G or K	3-4	Triumph	18-36	2450	2	Erld.	4-4 1/2 x 6	Ker.	4
Bates Mule, G	25-35	.....	2	Midw.	4-4 1/2 x 6	Gas.	3	Lauson Road	15-30	2225	4	Beav.	4-4 1/2 x 6	K	3-4	Trundar	25-40	3750	2	Wauk	4-5 x 6 1/2	G or K	4
Beaman	2-4	240	4	Own	1-3 1/2 x 4 1/2	G, K, D	4	Leader	12-18	985	4	Own	2-6 x 6 1/2	G, K, D	2-3	Turner	14-25	1295	4	Buda	4-4 1/2 x 5 1/2	G, K	3	
Best	18-30	3100	2	Own	4-4 1/2 x 6 1/2	G, K, D	8-9	Leader	16-32	1725	4	Clim.	4-5 x 6 1/2	G, K	3-4	Twin City	12-20	1200	4	Own	4-4 1/2 x 6	G, K	3	
Best	60	5450	2	Own	4-6 1/2 x 8 1/2	G, K, D	8-9	Leader	18-36	2150	2	Clim.	4-5 1/2 x 6 1/2	G, K	3-4	Twin City	20-35	2950	4	Own	4-5 1/2 x 6 1/2	G, K	5	
Boring	1921	1850	3	Wauk	4-6 1/2 x 8 1/2	GorK	4	Leonard	20-30	2530	4	Buda	4-4 1/2 x 6 1/2	G, K	3	Twin City	40-65	4750	4	Own	4-7 1/2 x 9	G, K	8	
Burn-Oil	1922	1435	4	Own	2-6 1/2 x 7	Ker.	3-4	Linn	40	4500	.....	Wauk	4-5 x 6 1/2	Gas.	4	Uncle Sam C20	12-20	1385	4	Weid.	4-4 x 5 1/2	G	2-3
Capital	15-30	1000	2	Own	4-4 1/2 x 6	Gas.	3	Linn	60	5000	.....	Wauk	4-5 x 6 1/2	K	6	Uncle Sam B19	20-30	2300	4	Beav.	4-4 1/2 x 6	G or K	3-4
Case	10-18	700	4	Own	4-3 1/2 x 5	GorK	2	Little Giant	16-22	2200	4	Own	4-5 1/2 x 6	K	6	Uncle Sam D21	20-30	1985	4	Beav.	4-4 1/2 x 6	G or K	3-4	
Case	15-27	1320	4	Own	4-4 1/2 x 6	GorK	3-4	Little Giant	25-35	3300	4	Own	6-5 1/2 x 6 1/2	Gas.	16	Universal	1-4	475	2	Own	1-3 1/2 x 4	G	1	
Case	22-40	2550	4	Own	4-5 1/2 x 6 1/2	GorK	4-5	Lombard 1921	85-150	.....	2	Own	4-4 1/2 x 6 1/2	Gas.	6-10	Utilitor	501 2 1/2	295	4	Own	1-3 1/2 x 4 1/2	G	1
Case	40-72	.....	4	Own	7 x 8	G, K, D	8-10	Lombard 1921	50	.....	2	Own	4-4 1/2 x 6 1/2	K&G	3	Vim	15-30	1190	4	Wauk	4-4 1/2 x 5 1/2	G, K	3
Caterpillar T11	25	3975	2	Own	4-4 1/2 x 6	Gas.	4	Magnet	14-28	1875	4	Wauk	4-4 1/2 x 6 1/2	G, K	3	Wallis	15-25	1995	4	Own	4-4 1/2 x 5 1/2	G, K	3	
Caterpillar T16	40	6050	2	Own	4-6 1/2 x 7	Gas.	6	Master Jr	5-10	585	4	LeR.	4-3 1/2 x 5	Gas.	1	Waterloo	18-25	675	4	Own	2-6 1/2 x 7	G, K	3	
Centaur	5-2 1/2	385	2	N Way	2-4 1/2 x 4 1/2	GorK	4	Merry Gar 1922	2	210	2	Evin	1-29 x 2 1/2	Gas.	3	Weblott	53	285	5000	2	Wisc.	4-5 1/2 x 7	G, D	6
Chicago	40	2500	4	Own	4-4 1/2 x 6	Gas.	1	Mime - All-P	12-25	900	4	Own	4-4 1/2 x 7	G or K	3	Wellington	18-22	.....	4	Erld	4-4 x 6	Ker.	2-3
Cletrac	9-16	595	2	Own	4-3 1/2 x 4 1/2	G, K, D	2-3	Mime - Gen-P	17-30	1675	4	Own	4-4 1/2 x 7	G or K	3-4	Wellington	16-30	.....	4	Chief	4-4 1/2 x 6	Ker.	3-4
Cletrac	12-20	1315	2	Own	4-4 x 5 1/2	G, K, D	2-3	Minne.	.....	.....	.....	.....	.....	.....	.....	Western, 1920	16-32	2100	4	Clim.	4-5 x 6 1/2	Gas.	4
Dakota	15-27	1500	3	Dom.	4-4 1/2 x 6	Gas.	3	Med.Duty	22-44	3000	4	Own	4-6 x 7	G or K	5-6	Wetmore 21-12	12-25	1185	4	Wauk	4-4 x 5 1/2	G, K	3	
Dart	15-30	1800	4	Buda	4-4 1/2 x 6	Gas.	3-4	Minne.	.....	.....	.....	.....	.....	.....	.....	Whitney	9-18	595	4	Own	2-5 1/2 x 6 1/2	Gas.	2
Depue	20-30	2500	4	Buda	4-4 1/2 x 6	Gas.	4	Heavy Duty	35-70	4150	4	Own	4-7 1/2 x 9	G or K	8-9	Whitney	17	1500	4	Beav.	4-4 1/2 x 6	G, K, D	3-4	
Dill	20	2380	4	Cont.	4-4 1/2 x 6 1/2	Gas.	3	Mohawk 1921	8-16	785	2	Light	4-3 1/2 x 4 1/2	G or K	1-2	Wisconsin E	16-30	1850	4	Clim.	4-5 x 6 1/2	G or K	4	
Dill	R.W.	20	2380	4	Cont.	4-4 1/2 x 6 1/2	Gas.	3	Moline Univ D	9-18	900	2	Own	4-3 1/2 x 5	Gas.	2-3	Wisconsin F	20-40	2050	4	Wauk	4-5 x 6 1/2	G or K	4
Do-It-All	A	3-6	595	.....	1-4 1/2 x 5	Gas.	1	Moline Orch.	9-18	990	2	Own	1-23 1/2 x 3 1/2	Gas.	2-3	Wisconsin H	22-40	2550	4	Clim.	4-5 1/2 x 7	G or K	4-6
Do-It-All	F	12-22	4	Own	2-7 x 8	GorK	3-1	Motex	15-30	2250	4	Buda	4-4 1/2 x 6	Gas.	3-4	Yuba	12-20	2400	2	Wisc.	4-4 1/2 x 6	G, K, D	3
Do-It-All	F	16-30	4	Own	2-8 x 8	GorK	4-5	NE	3-6	425	4	Own	2-3 1/2 x 4	Gas.	1	Yuba	15-25	2750	2	Wisc.	4-4 1/2 x 6	G, K, D	4
E-B	AA	12-20	1095	4	Own	4-4 1/2 x 5	G, K, D	3	Nichols-Shep.	23-42	2650	4	Own	8 x 10	G or K	3-6	Yuba	23-35	3000	2	Wisc.	4-5 1/2 x 7	G, K, D	4
E-B	Q	12-20	750	4	Own	4-4 1/2 x 5	G, K, D	3	Nichols-Shep.	25-50	3000	4	Own	9 x 12	G or K	4-7	Yuba	25-40	4630	2	Wisc.	4-5 1/2 x 7	G, K, D	4
E-B	16-32	1750	4	Own	4-5 1/2 x 7	G, K, D	4	Oil Pull	12-20	1035	4	Own	2-6 x 8	K, D	3	Zelle	25-40	.....	2	Yuba	4-5 1/2 x 7	D	.....
Evans	18-30	2000	4	Buda	4-4 1/2 x 6	G, K	3	Oil Pull	16-30	1750	4	Own	2-7 x 8 1/2	K, D	4									
Fageul	9-18	1525	4	Lyc.	4-3 1/2 x 5	Gas.	2	Oil Pull	20-40	2550	4	Own	2-8 x 10	K, D	5-6									
Farm Horse B	18-30	1885	4	Clim.	4-5 x 6 1/2	G, K	4	Oldsmar GarK	21-45	225	4	Own	1-5 1/2 x 5 1/2	Gas.	8-10									
Farquhar	15-25	.....	4	Buda	4-4 1/2 x 6	G, K, D	4-5	Oliver	15-30	.....	2	Beav.	4-4 1/2 x 6	G or K	3-4								
Farquhar	18-35	.....	4	Own	4-6 x 8	G, K, D	6-7	Over Over Til	.....	.....	.....	.....	.....	.....	.....		
Farquhar	25-50	.....	4	Own	4-7 x 8	G, K, D																	

COMING MOTOR EVENTS

AUTOMOBILE SHOWS

Bridgeton, N. J.	Automobile Show	Apr. 1-8
Bat. Creek, Mich.	Michigan Automotive Trade Assn.	Apr. 2-8
Canton, O.	Automobile Show	Apr. 3-8
Davenport, Ia.	Automobile Show	Apr. 3-8
Murphysboro, Ill.	Automobile Show	Apr. 3-10
New York City	Electric Automobile Show	Apr. 3-15
Holdrege, Neb.	Automobile Show	Apr. 5-8
Sioux Falls, S. D.	Automobile Show	Apr. 5-8
Marinette, Wis.	Automobile Show	Apr. 6-8
Asbury Pk., N. J.	Automobile Show	Apr. 10-15
Johnstown, Pa.	Automobile Show	Apr. 10-15
Butte, Mont.	Automobile Show	Apr. 15-23
Wins. Salem, N. C.	Automobile Show	Apr. 11-17
Columbia, S. C.	Automobile Show	Apr. 17-22
Goldsboro, N. C.	Automobile Show	Apr. 18-22
Mitchell, S. D.	Automobile Show	Apr. 20-22
Mt. Vernon, Ill.	Automobile Show	Apr. 24-30

Chicago	Used Car Show	Apr. 26-May 4
Williamson, W. Va.	Automobile Show	May 10-13
Hartford, Conn.	Automobile Show	Sept. 4-9

FOREIGN SHOWS

Mexico City	Automobile Show	Apr. 16-23
Rio de Janeiro	Automotive Exhibition	Sept., 1922

CONVENTIONS

Colo. Spgs., Colo.	Automotive Equipment Assn.	June 9-24
White Sulphur Springs, W. Va.	S. A. E. Summer Meeting	June 20-24
Olympia	Washington Automotive Trade Assn.	July 21-22

RACES

Indianapolis	500-Mile Classic	May 30
Colo. Spgs., Colo.	Pike's Peak Race	Sept. 4
San Carlos, Cal.	500-Mile Armistice Day Race	Nov. 11

How the Kansas City Garageowners' Association is Putting Service On a High Plane and Benefitting Its Members

THE way to put a local garagemen's association on its feet is to hire a secretary.

The garagemen of Kansas City have proved it.

The Kansas City organization has a definite objective; and it is now part way towards that objective.

The present secretary, who has been working since July 1, was picked because he was a big enough man for the job—and had a vision of the good that could be done by means of organization of garagemen. He is E. D. McKim, formerly district manager for the Foamite Firefoam Co., a fire protection engineer.

Worked Out Uniform Bookkeeping System

Perhaps the greatest accomplishment of this Kansas City Garage Owners' Assn. is the encouragement towards systematizing of garage business. The association has a "system committee," whose duty it is to help members in the installation of orderly methods, both in shop and office departments. The chairman of this committee is W. R. Demster, pioneer motor machine shop operator; he and the committee have given much time to visits to garages, and conferences on the shop or office problems of owners.

As one result of this committee's activity, the Kansas City association is now preparing to adopt and install a uniform system of bookkeeping in members' garages. The first purpose in such a program, is to provide every garage owner with an accounting system that will be of value to him; the secondary purpose, is to provide among the members, a standardized system whereby intelligent exchange of information may be possible, on costs. The desire for a standard system, and the inclination to consider accounting at all, has sprung from the many discussions of the subject, at the regular sessions of the association. For

this subject has been on the program more often than any other.

Car Owner Complaints Reduced

Another of the real accomplishments of the association is the vast reduction in complaints against garageowners, by car owners. There are still complaints—but it has been estimated that there are not ten per cent as many, as a year ago. And a far more significant comparison is in the "complaints to other motor owners." The garageowner may be able to save the disgruntled customer who comes to him with his troubles; the customer who does the most damage, is the one who "knocks" the garage owner to other motorists. And the Kansas City association has reduced that sort of complaining to an extent that is said to be exceedingly gratifying.

Complaints are turned over to a grievance committee which fairly considers the facts of the case on both sides and gives a ruling which is accepted by both the car owner and the garage owner, no matter which is favored, as a just settlement of the complaint.

The Kansas City association has on its roll 55 out of the 200 garagemen of Greater Kansas City. Applicants for membership are required to qualify and only those willing to live up to association standards are admitted.

Benefits of Combined Buying Power

Substantial revenue was attained through the personal activity of the paid secretary, and reflects the use of the combined buying power of the organization. The members buy about 100,000 gallons of gasoline a month, and 100 barrels of motor oil.

They had not been making any profit on sales of gasoline. The desire for profit on this commodity and the need of revenue were coordinated to produce a contract with an oil company, for sup-

plying all members. This contract not only provides for gasoline at a discount under which the garagemen can make money selling it, but also carries a fixed sum for advertising to each monthly. And the gasoline and oil are distributed without selling expense—except a "commission" to the association, which yields the association about \$150 a month, under present volume.

Magazine Sent to Car Owner

During 1922, the association will have funds, and it has the equipment, to enter upon both publicity and legislative work. For one publicity item, a copy of the monthly magazine is to be sent to each customer of each member. This distribution will cover several months, about a thousand copies being sent out each month. The "Journal" is the bulletin of the association, designed primarily for its own members; and in sending it to car owners, the garagemen are "laying their cards on the table," showing the customers exactly what the association is doing, and how its program tends to the better service of the car owner.

Protection From Inimical Legislation

One item in the legislative program, is readjustment of licenses in Kansas City. At present there is serious discrepancy, especially against the garagemen, who has both storage and shop. Another item has to do with state legislation for the protection of the garage owners' interests in a car on which there is an unpaid repair bill. At present the mortgage takes precedence of the garageman's lien.

"We expect to get into the subject of 'selling' later," said Mr. McKim. "So far we are emphasizing service exclusively; it is a service association for improvement of service. When we have developed our methods in selling service, we may then tackle the matter of handling, displaying and selling accessories."